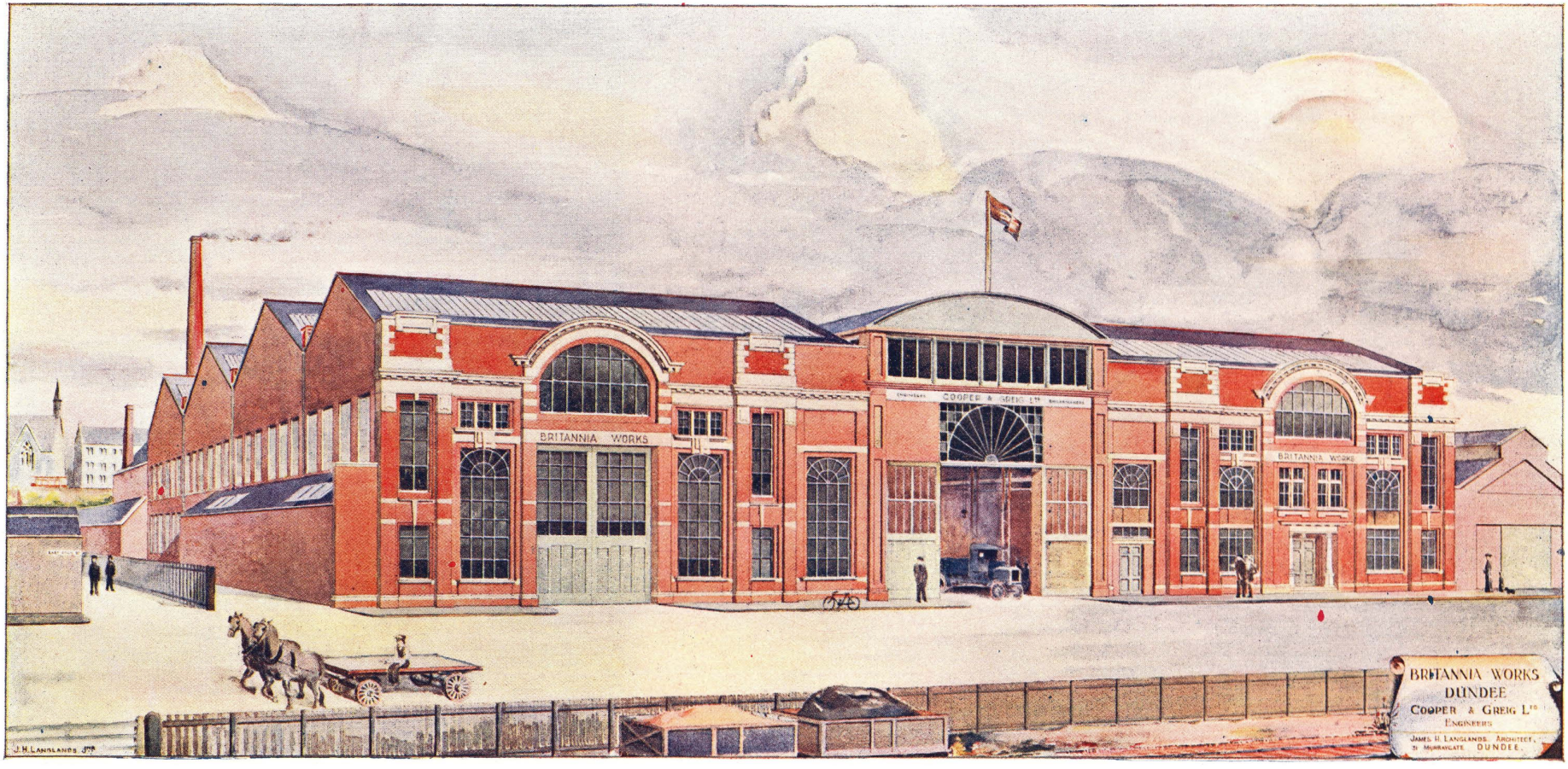
COOPER & GREIG LTD.

BRITANNIA WORKS
DUNDEE
SCOTLAND

ENGINEERS AND BOILERMAKERS

Catalogue of Machinery


BRITANNIA WORKS
COOPER & GREIG LTD
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DUNDEE
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ENGINEERS
JAMES H. LANGLANDS. ARCHITECT.
21 MURRAYGATE. DUNDEE.
J.H. LANGLANDS JUN.

TELEPHONE
962.

CODES:
LEIBER & A.B.C. (5th EDITION.)

TELEGRAMS:
"CONDENSER, DUNDEE."

COOPER & GREIG, LTD.

Contractors to H.M. and India Governments.

Marine Machinery.

MACHINERY for Screw-propelled Vessels, and also for Paddle Vessels, Compound or Triple Expansion, with saturated or superheated steam; also Diesel and Semi-Diesel for all types of Vessels.

Steam Generators.

BOILERS of all descriptions, Marine Return Tube, Locomotive, Water Tube, Lancashire, Upright, including all auxiliaries, also Tanks, Buoys, and Steel Bridges of Moderate Span, &c. &c.

Condensing Plant.

WE SUPPLY Surface Condensers, Evaporative Condensers, Barometric Condensers, also Jet Spray Coolers, Tower Coolers, and Open Stack Coolers, Circulating Pumps, Air Pumps, Force Pumps, Feed Pumps, &c. &c. Feed Heaters, Evaporators, Filters, Oil Separators, Superheaters, Air Heaters, Forced Draft Fans, Mechanical Furnaces, &c. &c., including all the necessary auxiliaries required to complete the most economical working Steam Plant.

Land Engines.

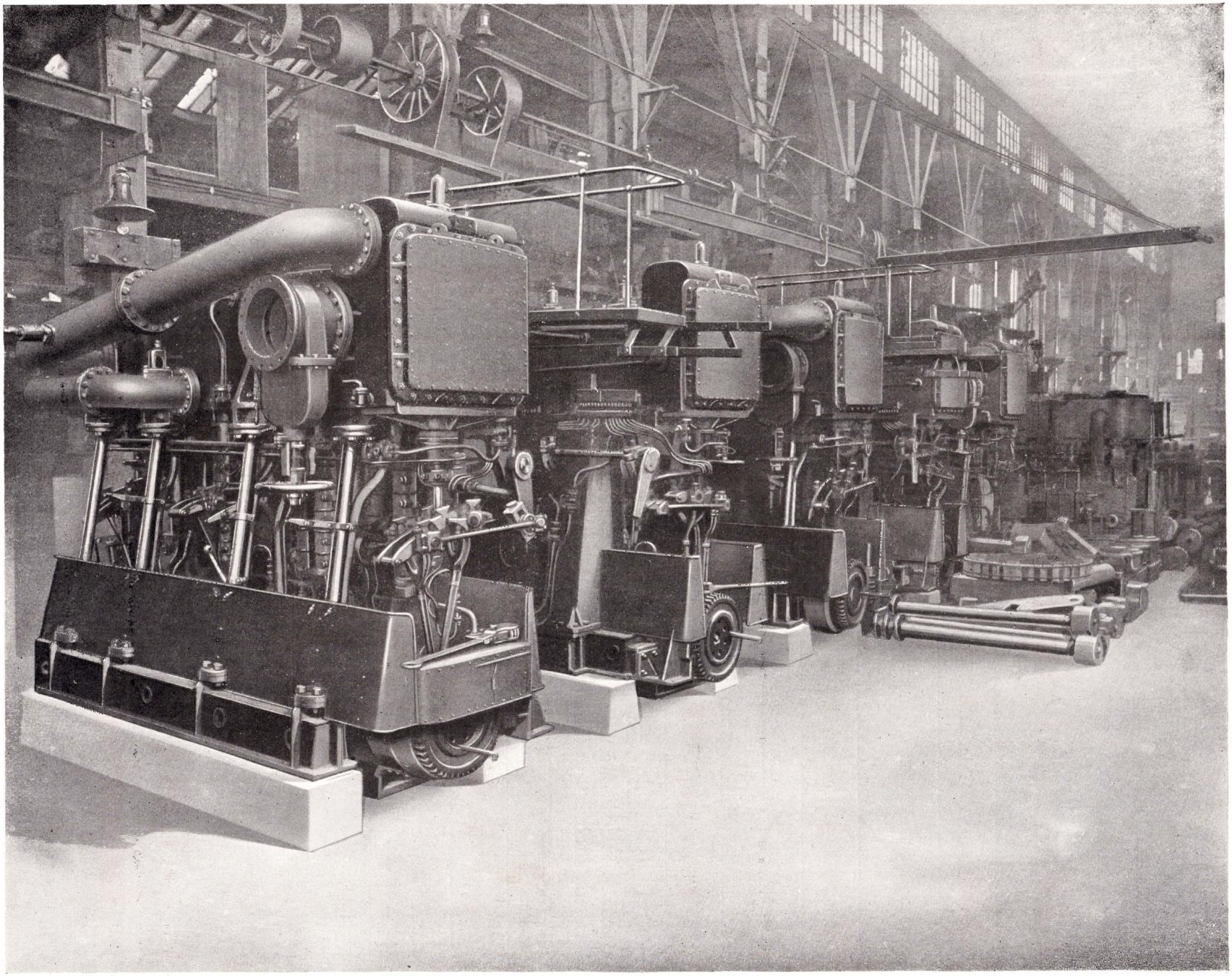
WE SUPPLY Land Engines suited for the use of saturated or superheated steam, Single Cylinder Expansion, Compound, or Triple Expansion, built as Horizontal Side-by-Side or Inverted Vertical. We also supply Steam Turbine Engines for any service. The details of construction, such as valve gear, shafting, framing, flywheel, pistons, rods, pumps, &c., are arranged to suit the duty, whether for direct coupling, or Mill driving by ropes, belts, or gearing.

We are glad to correspond at any time where work is being considered either for Marine or Land Service, and will be glad to furnish Plans and Estimates for any Complete Plant.

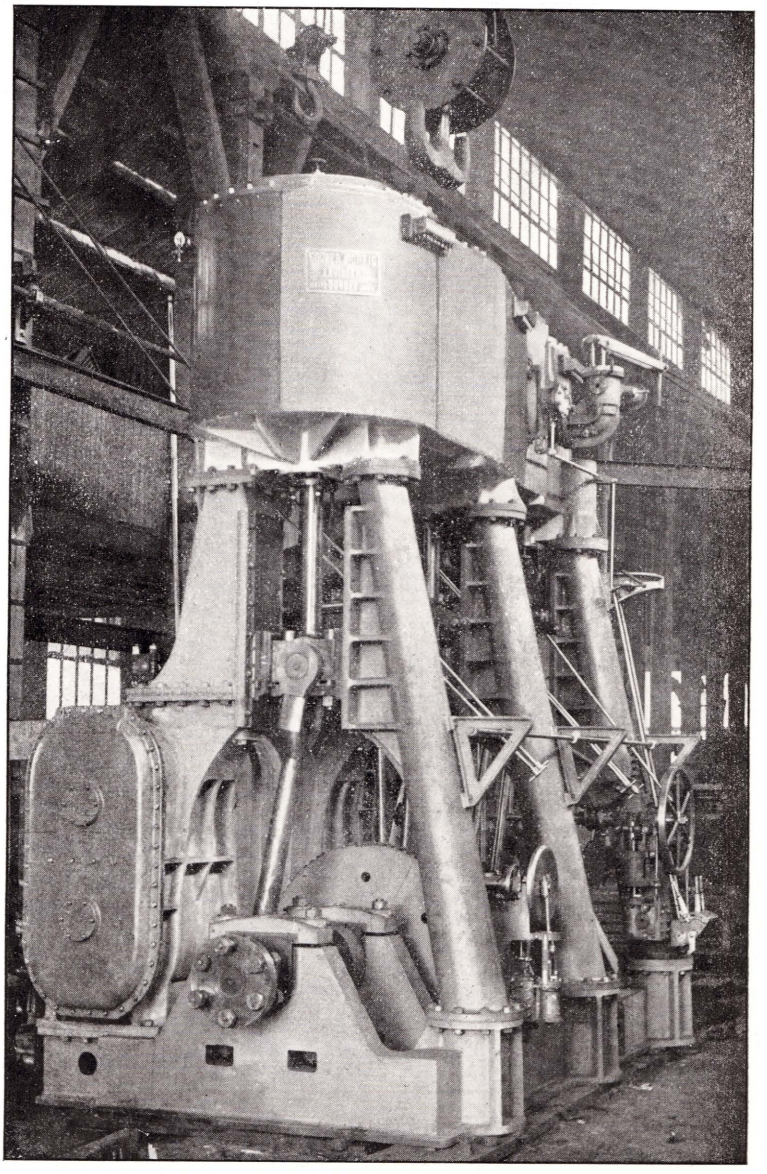
ENGINEERS, BOILERMAKERS & IRONFOUNDERS,

DUNDEE, SCOTLAND.

On Admiralty List.

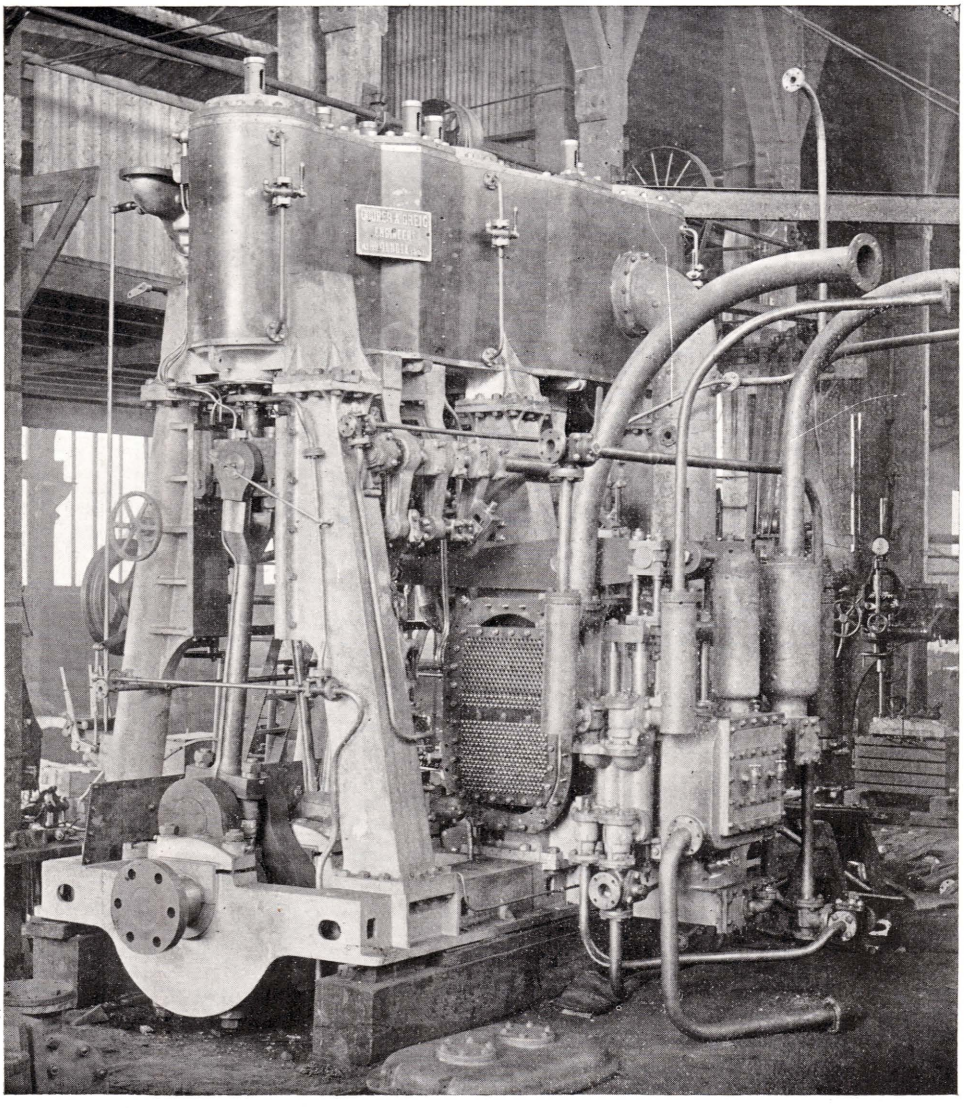


TWIN SCREW MARINE ENGINES.—SEVERAL SETS UNDER CONSTRUCTION.

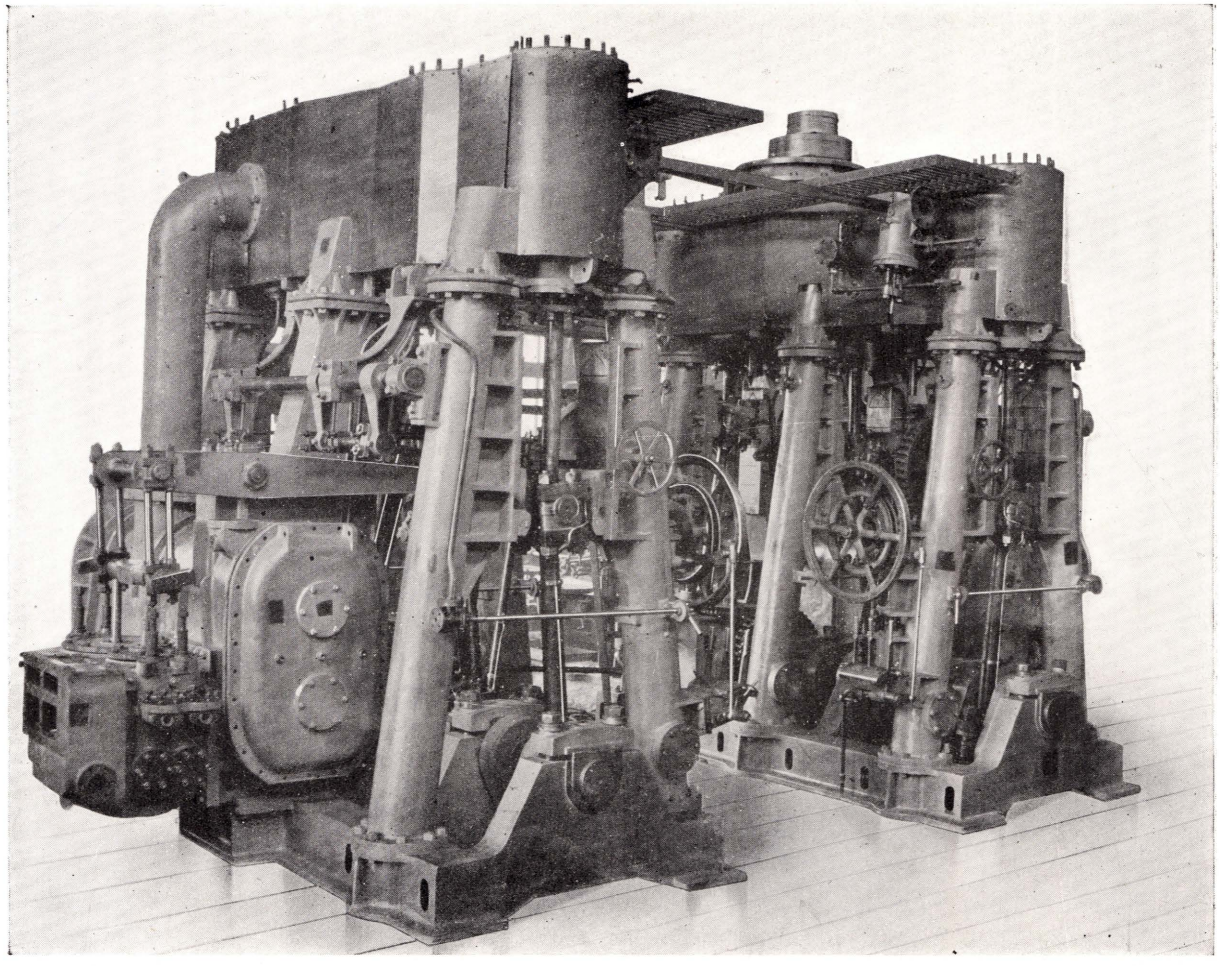


2000/3000 I.H.P. TRIPLE EXPANSION ENGINES, with Piston or Slide Valves, &c., suitable for any pressure up to 200 lbs. and superheat to 600 degrees; lowest steam consumpt per H.P.

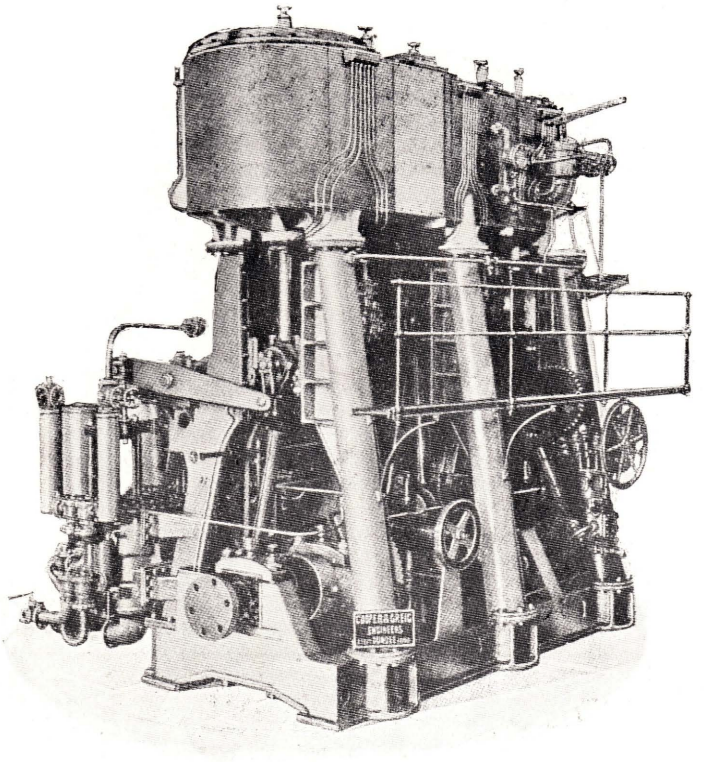
Suited for Passenger or Cargo Vessels.



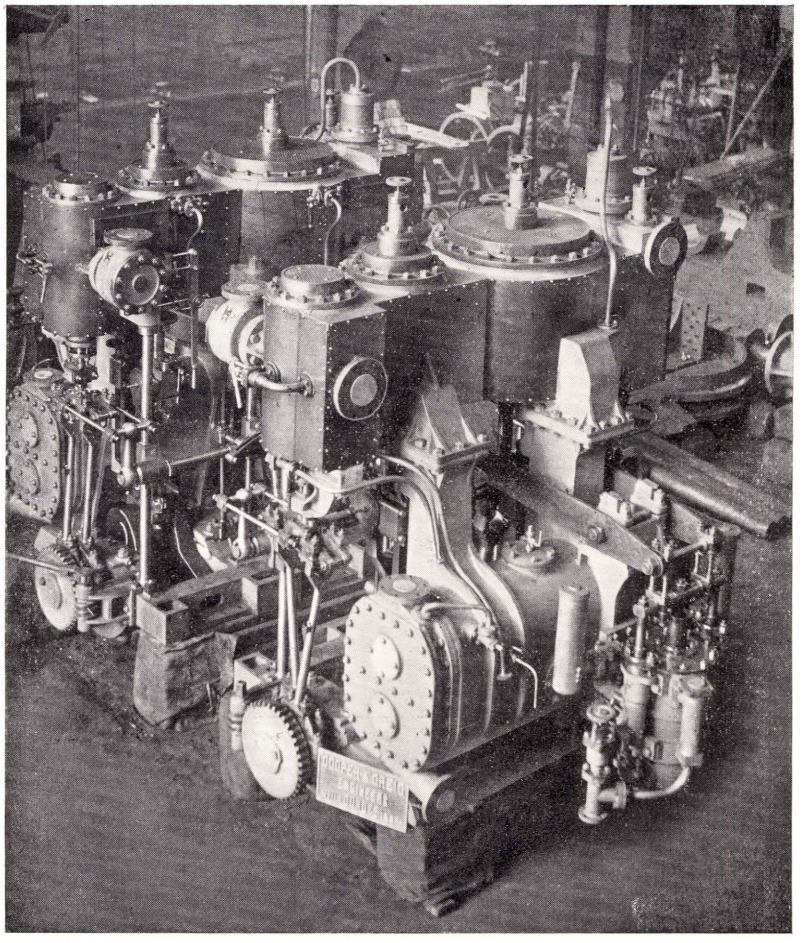
900 H.P. TRIPLE MARINE ENGINE being completed and fitted with Copper Piping in shops.



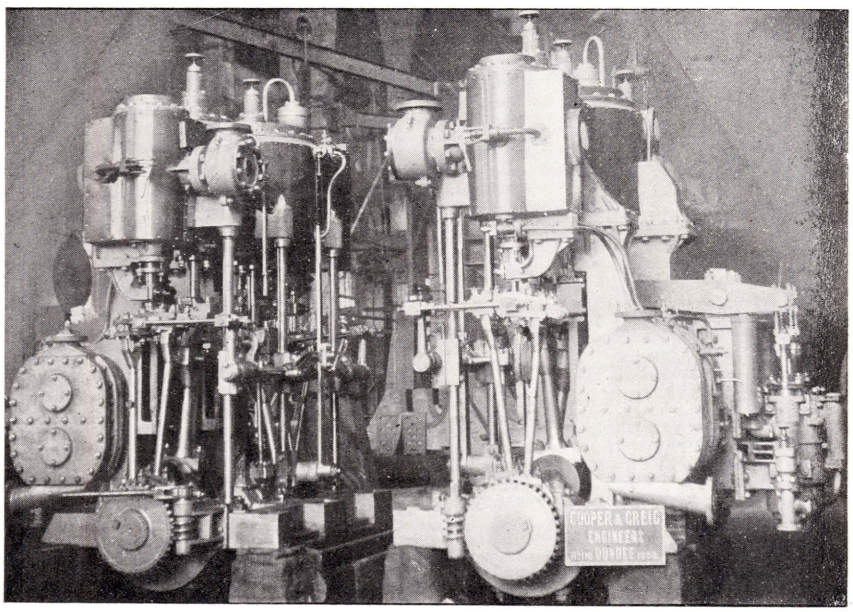
1600 I.H.P. TWIN SCREW TRIPLE ENGINES being completed in Shops



1200 I.H.P. TRIPLE MARINE ENGINE nearing completion in Shops.



COMPOUND TWIN SCREW ENGINES for Quick Revolution High-speed Passenger Vessel. Fitted with Piston Valves for H.P. and Balanced Slide for L.P., Quick Action Reversing Gear, Centrifugal Circulating Pump, &c.



COMPOUND TWIN SCREW ENGINES for Small Passenger Vessel.

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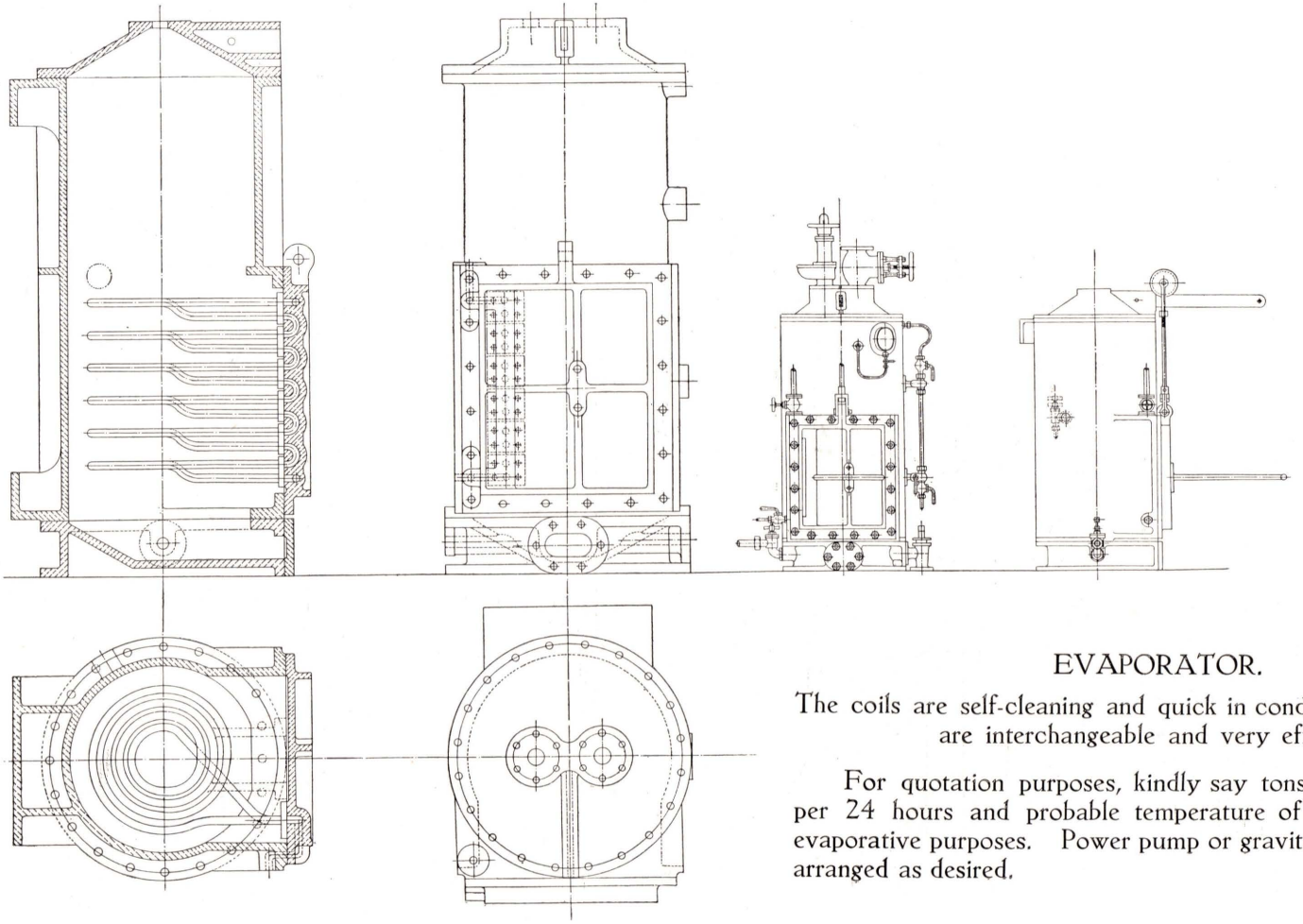
DUNDEE



EVAPORATOR.

The coils are self-cleaning and quick in condensing action. All are interchangeable and very efficient.

For quotation purposes, kindly say tons of water required per 24 hours and probable temperature of water entering for evaporative purposes. Power pump or gravitation supply can be arranged as desired.

COOPER & GREIG · Ltd
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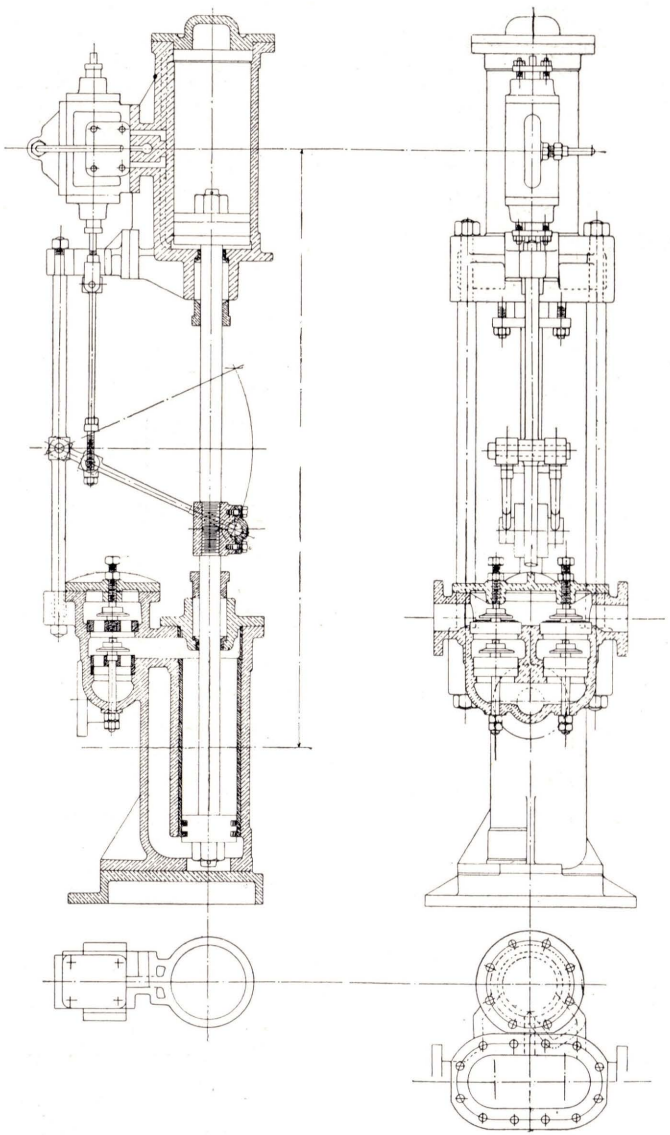
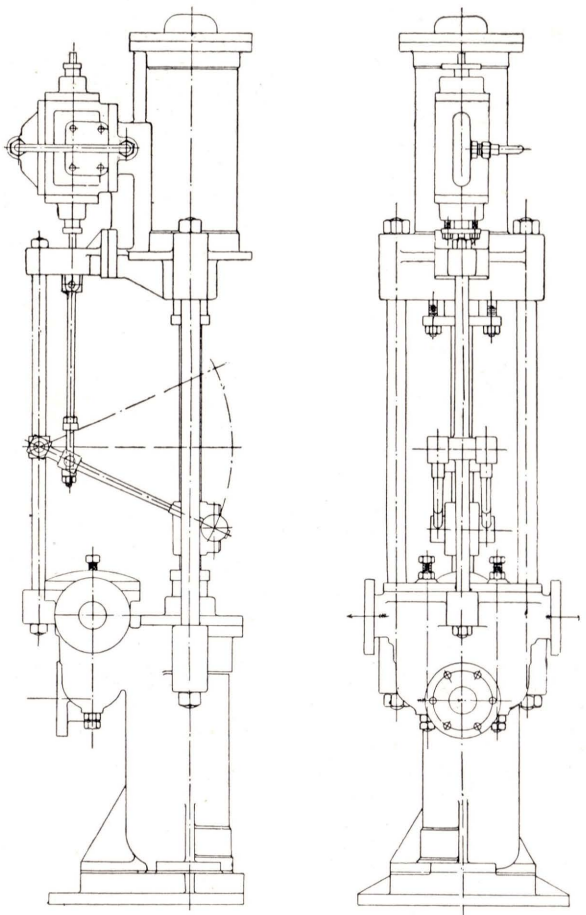
DUNDEE





LONG STROKE FEED PUMP.

Made for any service or pressure, and fitted with automatic action.
For land or marine service.
For quotation purposes, please say available pressure of steam and quantity of water to be supplied per hour.

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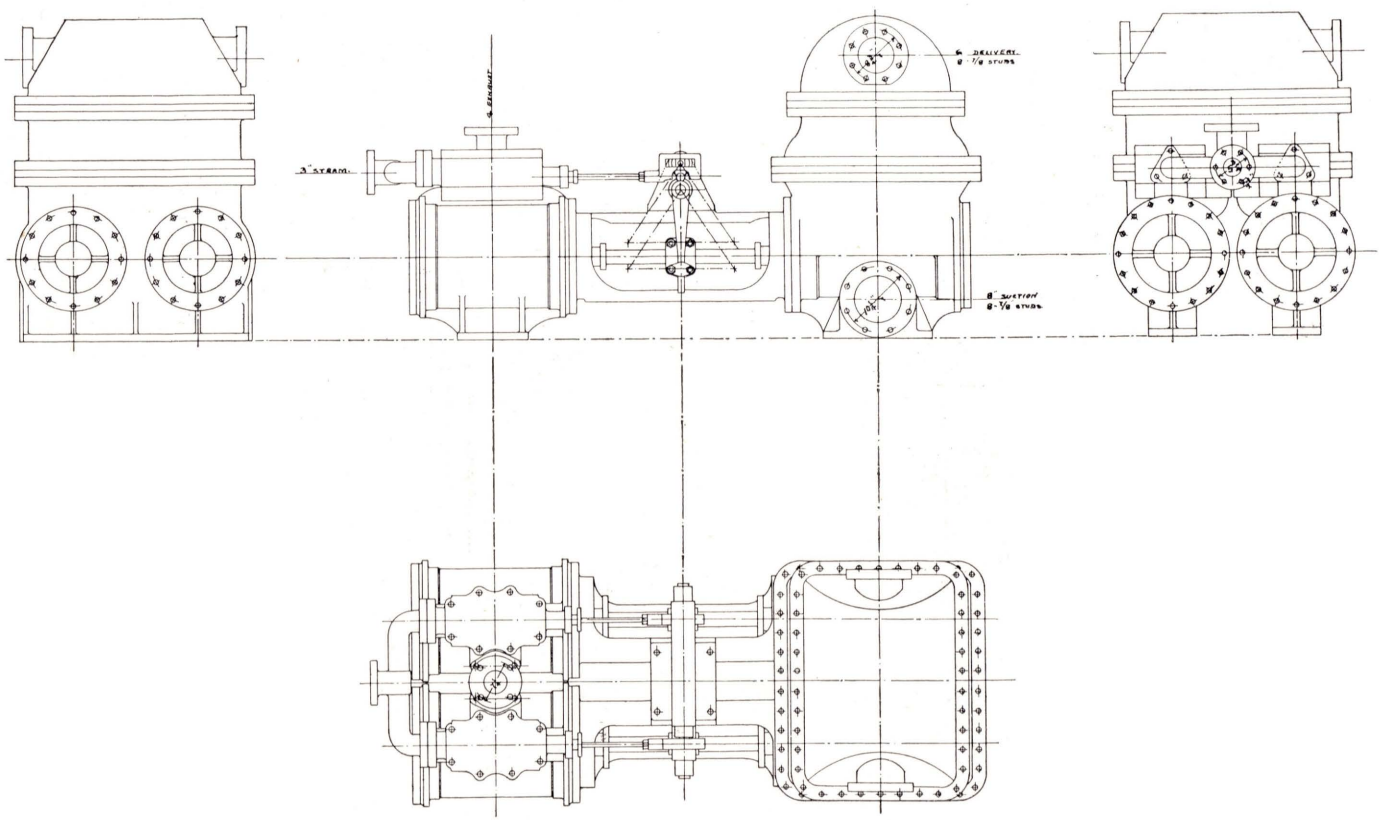
DUNDEE



BALLAST PUMP.

For water or oil service. Very strong and substantial for any pressure of steam and forcing. Pumps single, compound, or triple as required. Steam valves are balanced and valve motion is adjustable from outside. Brass valves in groups with brass valve seats. Brass pump rods and liners.

For quotation purposes, please say gallons per hour, steam pressure, and pumping pressure required.

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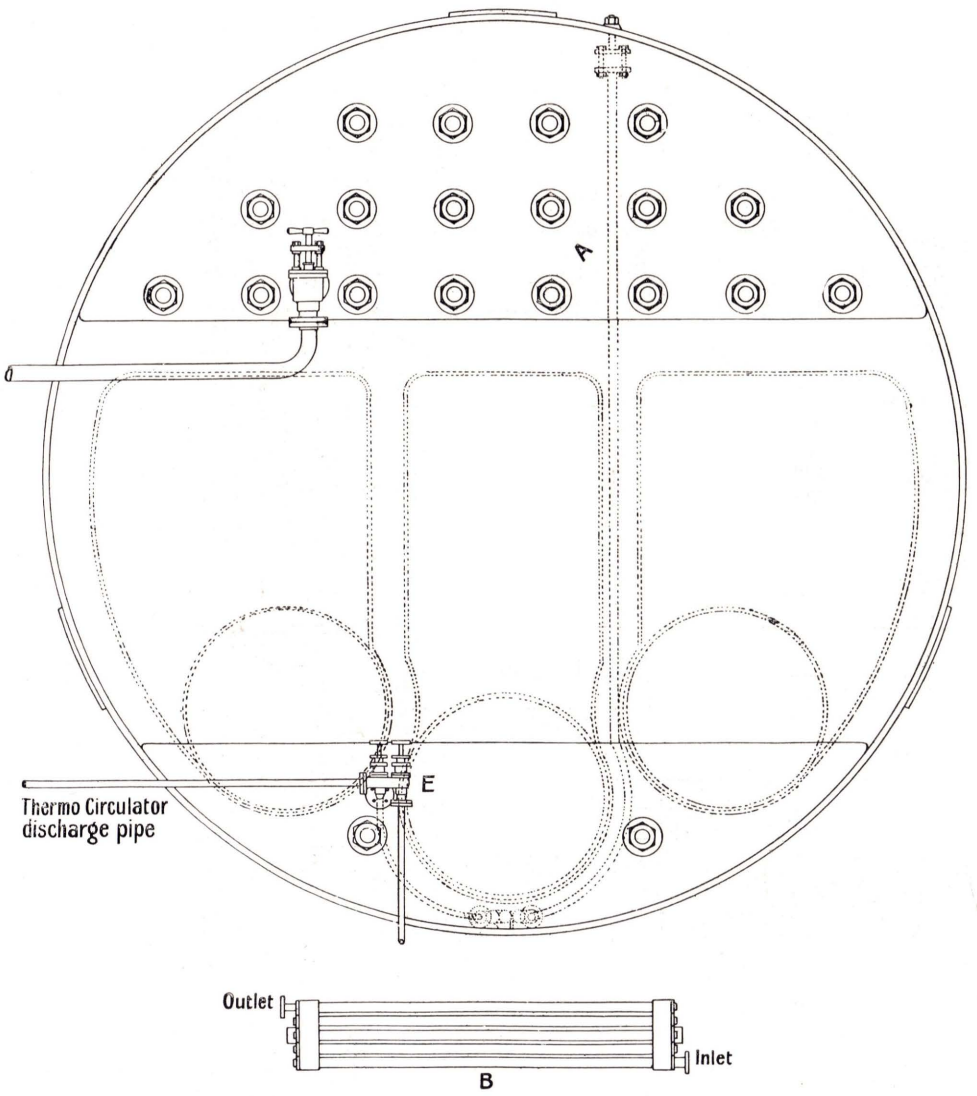
ENGINEERS & BOILERMAKERS
DUNDEE

FIG. I.



For quotation purposes, say size of boiler, number of furnaces, and pressure of steam.

"THERMO CIRCULATOR."

In using High Pressure Steam Boilers, it is admitted to be of the utmost importance that strains set up in the structure by unequal heating, &c., should be guarded against in order to prevent troublesome and expensive repairs.

For prevention of such expansion strains our **"Thermo Circulator"** has been expressly designed so that from the time of getting steam until the boilers are again out of commission there will be an equable temperature adjusted between all parts of the boiler.

The action of the **"Thermo Circulator"** will be understood by reference to Fig. I. A strongly built coil or gird (B), shorter than the length of the boiler and of a suitable width for passing through the bottom manhole, is placed as shown. One end of the coil is connected to the verticle pipe (A), the open end of which terminates in the highest point of the steam space.

The other end of the coil communicates with a valve box (E) fixed on the outside of the boiler shell or end plate. When the boiler is at work, or steam is being raised, steam passes down pipe (A) to the heating coil (B), and is there condensed, giving up its sensible and latent heat to the relatively cooler water surrounding the coil, then passing as condensed water through the valve box (E), finally being discharged to a tank or the engine hot well by a suitable steam trap; the action continuing while any sensible difference of temperature exists between the bottom of the boiler and the steam space. No air locking can take place.

In the case of a number of boilers, each heats itself, and the water of condensation is returned by a common feed pipe. Heating by the circulator is gradually and only completed when bottom plate is equal in temperature to top plate. The water of condensation being returned to boiler, there is practically no loss of heat nor is there any extra machinery at work.

A diagram is appended, which has been plotted from results of careful tests carried out on Marine Boilers fitted with the **"Thermo Circulator."** The curves show graphically the rise in temperature of the top and bottom plates of the boilers and the time taken to raise steam with the **"Thermo Circulator"** in action and out of action. The horizontal ordinate of the diagram represents the time in hours, while the vertical ordinate represents the temperature in degrees Fahrenheit. It will be noticed that with the **"Thermo Circulator"** out of action even after 20 hours had been allowed to raise steam to 200 lb., the temperature of the bottom plate only rose to 90° F., and, although the firing had been slow and regular, leakage occurred at shell butt straps and at bottom and front of furnaces. With the **"Thermo Circulator"** in action steam was raised to 200 lb. pressure in eight-and-a-half hours, the temperature of the bottom plate rising to 300° F. During this test no leakage took place at any part of the Boiler.

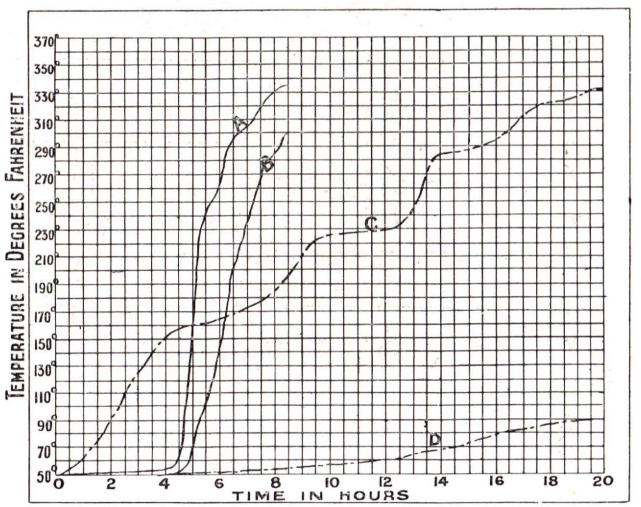
In vessels having High Pressure Boilers fitted with our **"Thermo Circulators,"** voyage after voyage has been accomplished without any trouble from usual expansion leaks.

The **"Thermo Circulator"** saves Combustion, Chamber Bottoms, Shell Bottoms, Ends, and Furnaces, and therefore lengthens the life of high pressure internally fired boilers.

The **"Thermo Circulator"** has stood the test of many years, working in both Marine and Land Boilers.

TESTS OF MARINE BOILER WITH AND WITHOUT "THERMO CIRCULATOR."

FIG. 2.



Curve A shews rise in Temperature of Boiler Top with Circulator in Action.
Curve B " " " Bottom " "
Curve C " " " Top, Circulator out of Action.
Curve D " " " Bottom, " "

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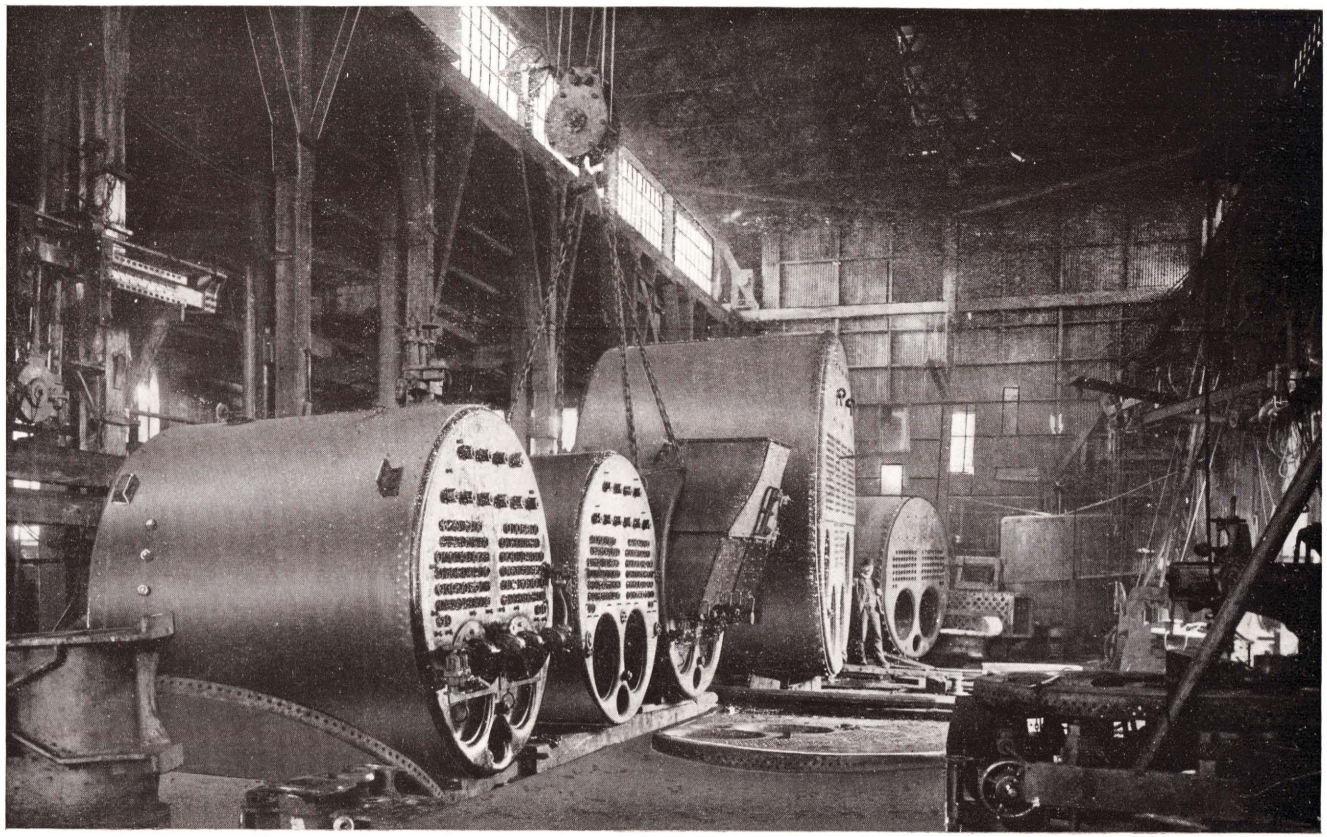
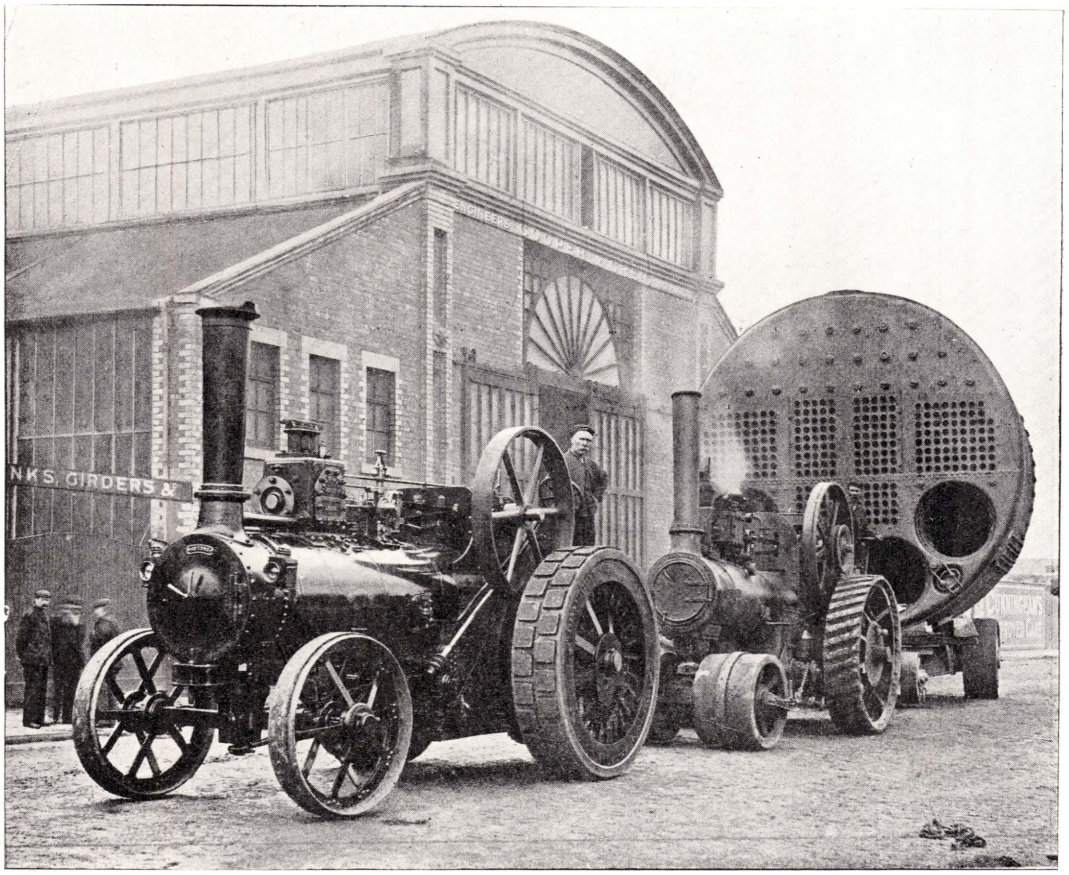


CORNER OF BOILER SHOP with HIGH-PRESSURE MARINE BOILERS in different stages of construction.



HIGH-PRESSURE FOUR FURNACE MARINE BOILER.

We make Return Tube Boilers in Steel, with furnaces either corrugated or plain, and for working pressures up to 200 lb. or over, to pass Board of Trade, Admiralty, or Lloyds' Survey, &c. These Boilers are usually fitted on board vessels, but we have fitted them ashore where space was not available for Lancashire or other Boilers. They are more expensive, but very economical steam raisers. The Boiler illustrated weighs about 60 tons, and is suited for 180 lb. working pressure, diameter over 16 feet.

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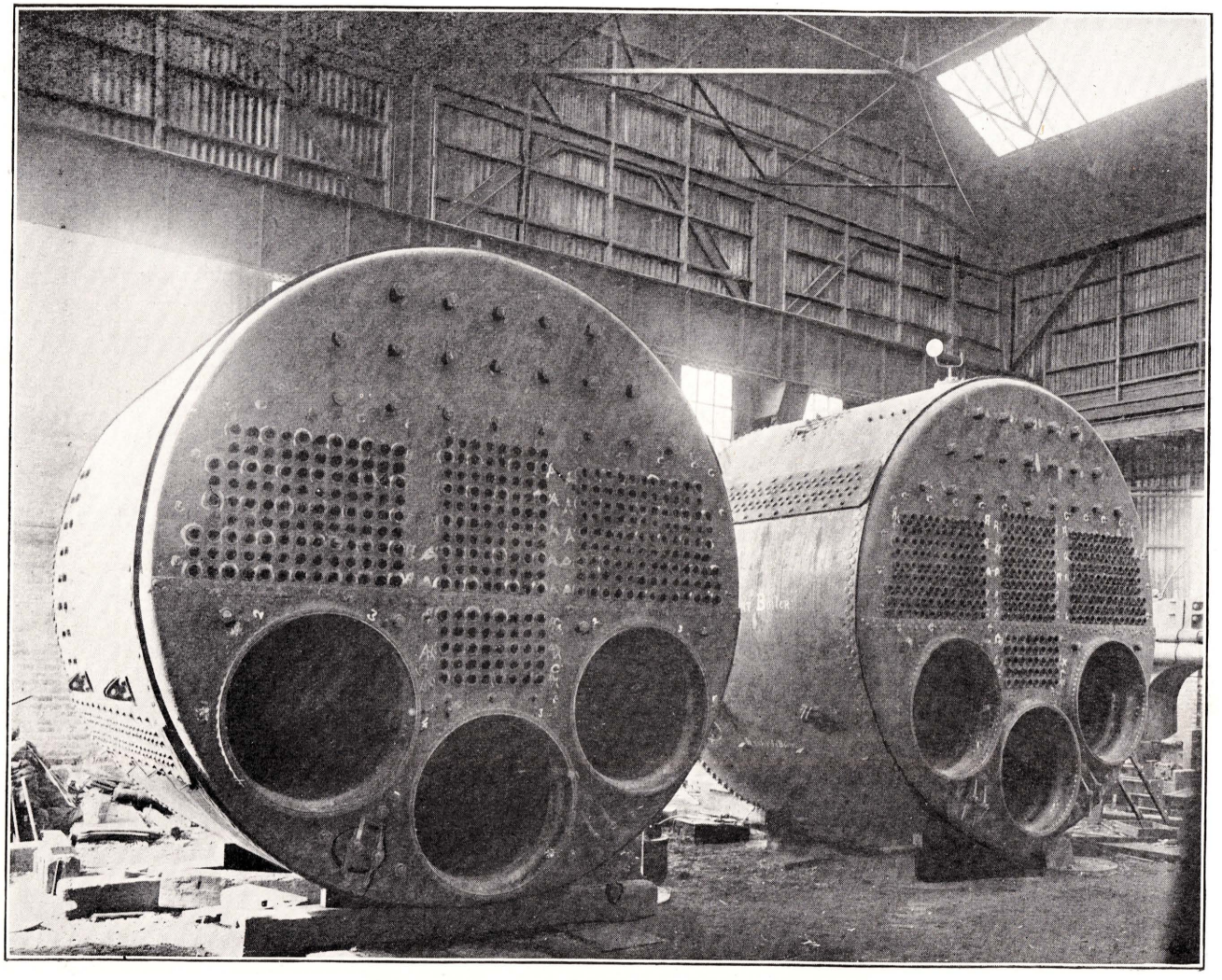


MARINE BOILERS under Construction.

A Few Illustrations of Various Plant Manufactured by us for Land Purposes :

Corliss & Drop Valve Engines

Lancashire Boilers

Condensing Plant

Cornish Boilers

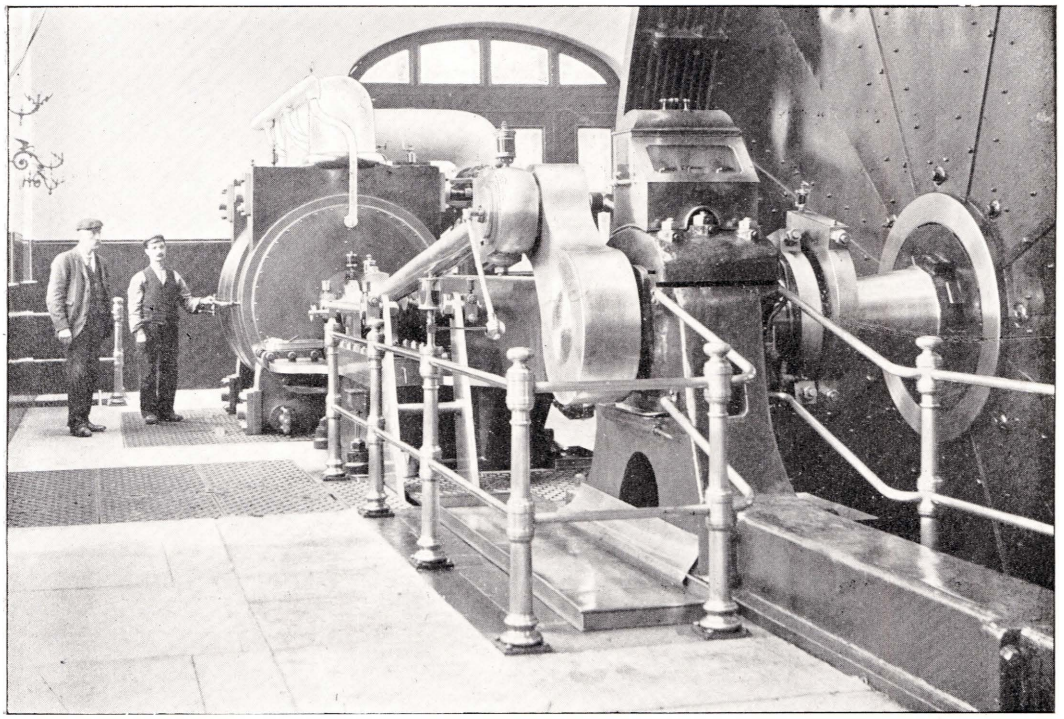
Hydraulic Gearing

Super Heaters

Feed Heaters

Oil Separators

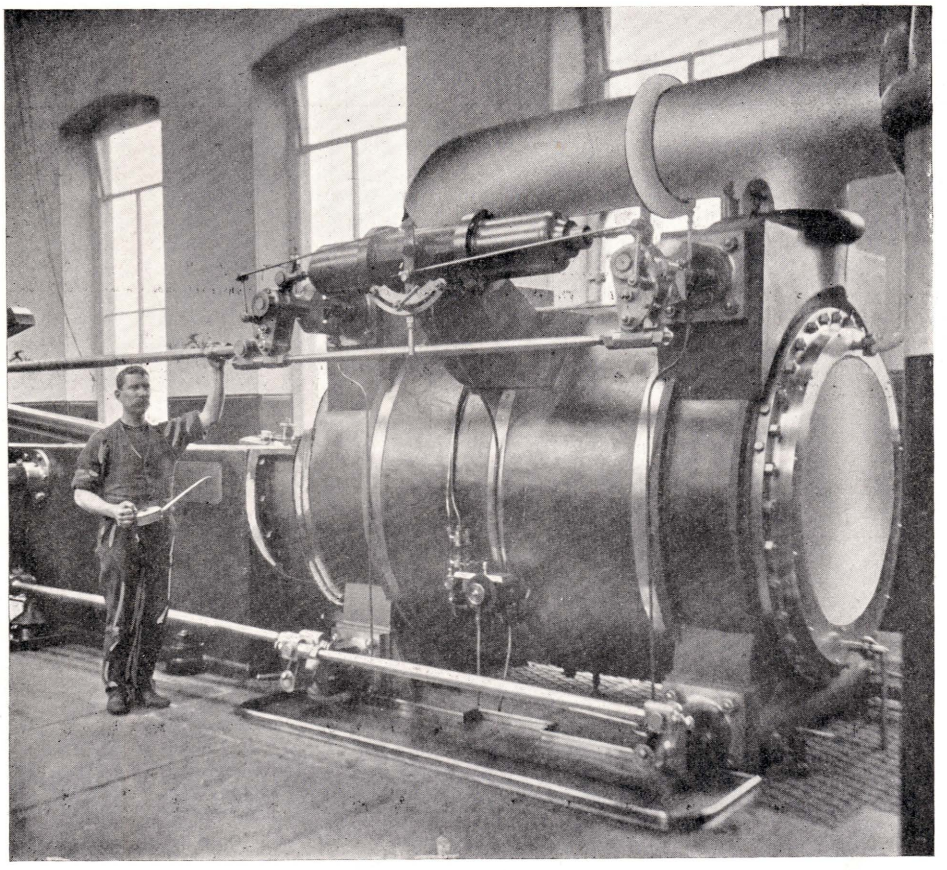
PATENT OIL FUEL INSTALLATIONS
for Burning Low Grade Fuel



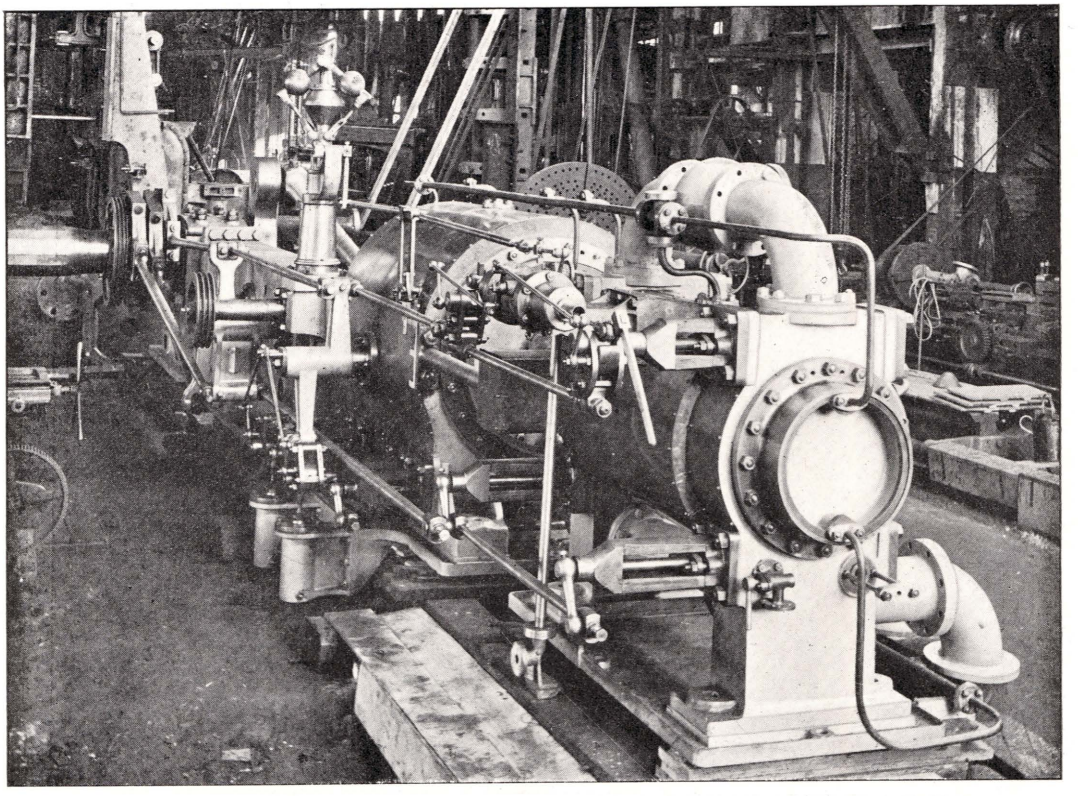
STANDARD TYPE OF HORIZONTAL RECIPROCATING ENGINE for Mill Driving, constructed with Corliss Valves, Piston Valves, Double-beat Drop Valves or ordinary Slides as may be required for service.

Suitable for Paper Mills, Rice Mills, Jute Mills, Oil Mills, Cotton Mills, &c.

For quotation purposes please say I.H.P. required, steam pressure, revolutions, and whether for rope, belt, or gear driving.

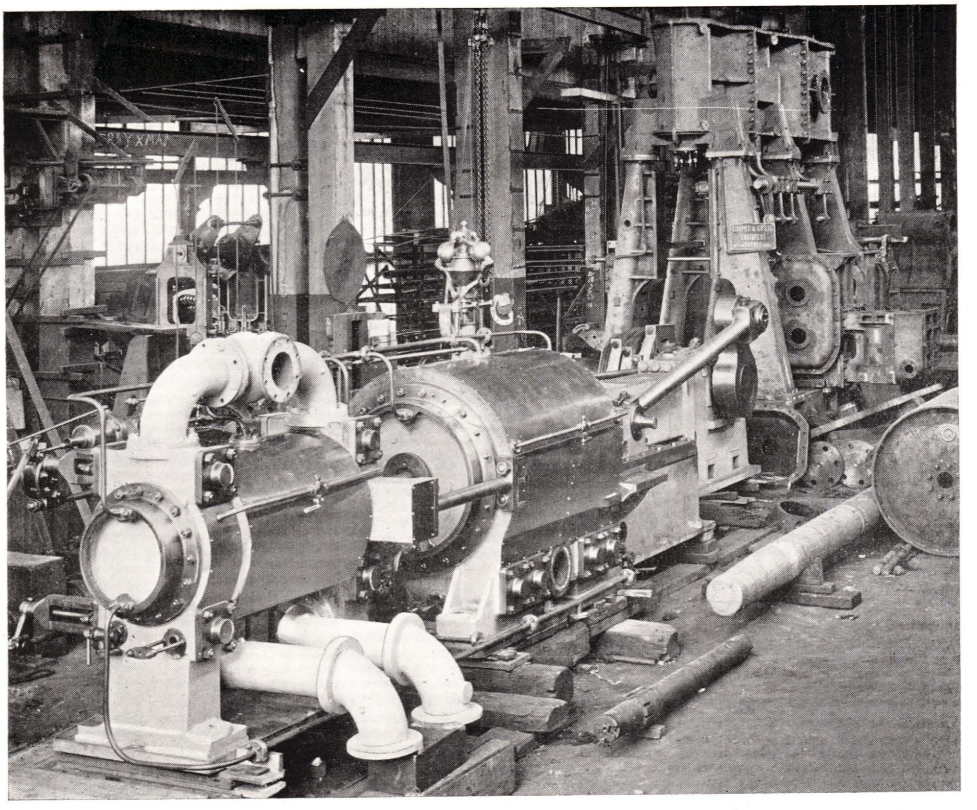


STANDARD TYPE OF CORLISS VALVE MOTION for L.P. Steam and Exhaust Valves.



STANDARD TYPE OF TANDEM CORLISS ENGINE
〈During construction in our Works〉.

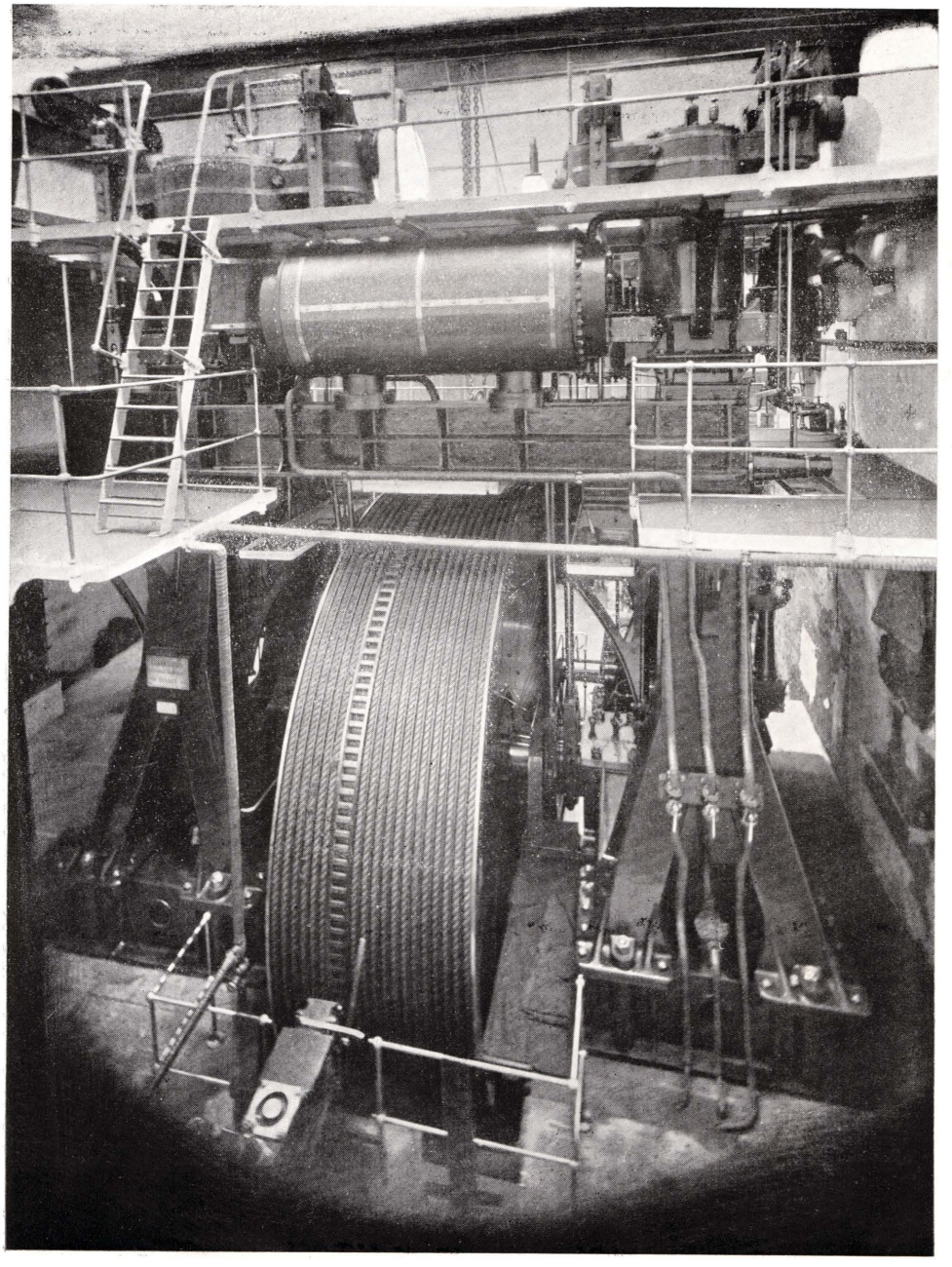
These Engines, using superheated steam and fitted with double beat valves, use 10 lb. to 12 lb. of steam per I.H.P. per hour; boiler pressure 150 lb. to 160 lb. Engines running at normal speed and loads, vacuum 26/27 inches. Pistons are carried upon special white bronze shoes moving upon lower portion of cylinder barrel, or by separate tail rod to carry weight of piston off barrel when a high superheat is used to obtain greater steam economy.



COMPOUND CORLISS MILL ENGINE and TRIPLE MARINE ENGINE, being completed in Shops.

Trunk framing carried to foundations. Crosshead, guides, connecting rod, piston rod, and gland, &c., readily examined.

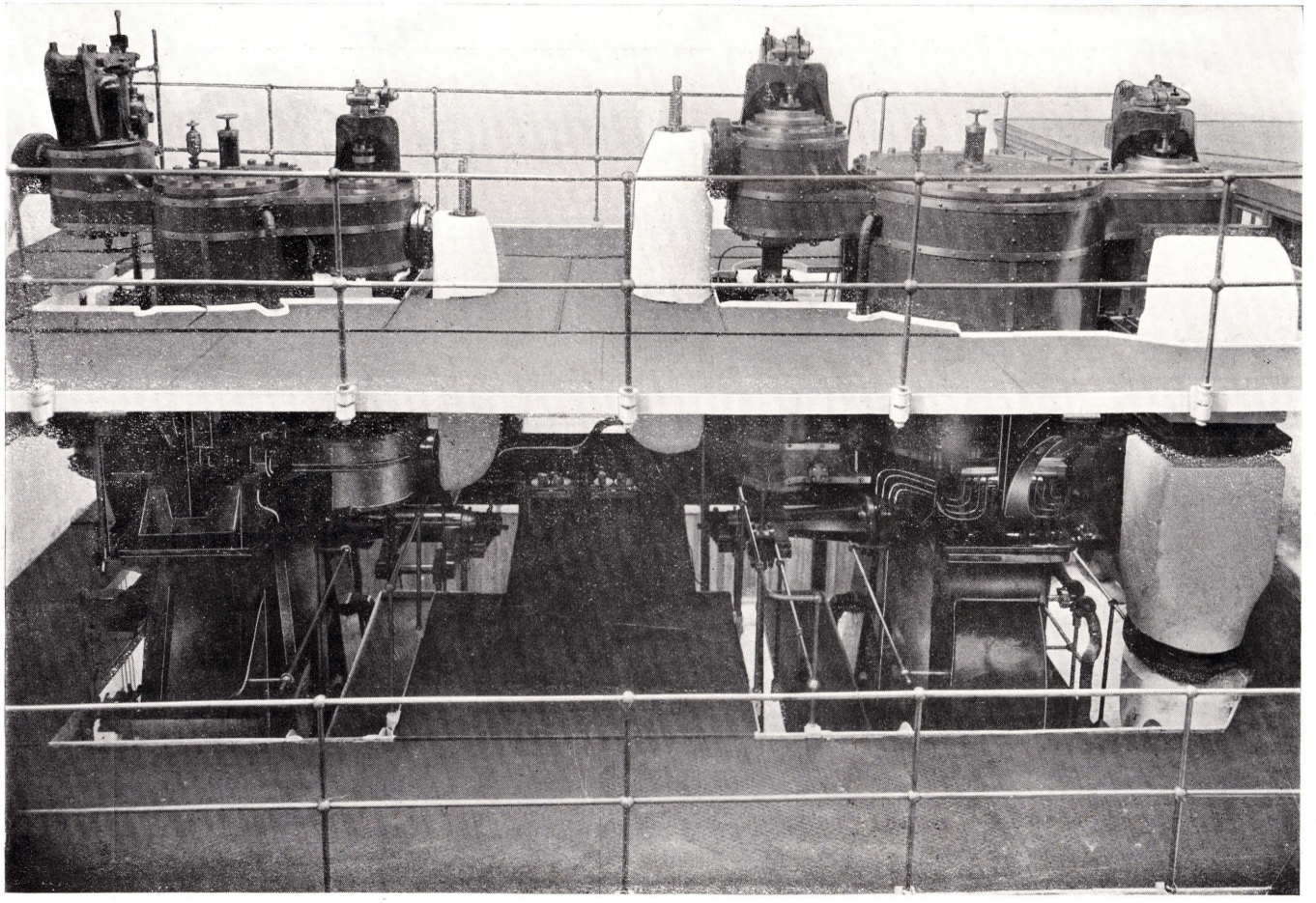
For quotation purposes please say I.H.P. required, steam pressure revolutions, and whether for rope, belt, or gear driving.



2000/3000 H.P. COMPOUND INVERTED VERTICAL MILL ENGINE, with double-beat valves, &c., suitable for superheated steam, automatic regulating gear, steam turning gear, surface or jet condensing.

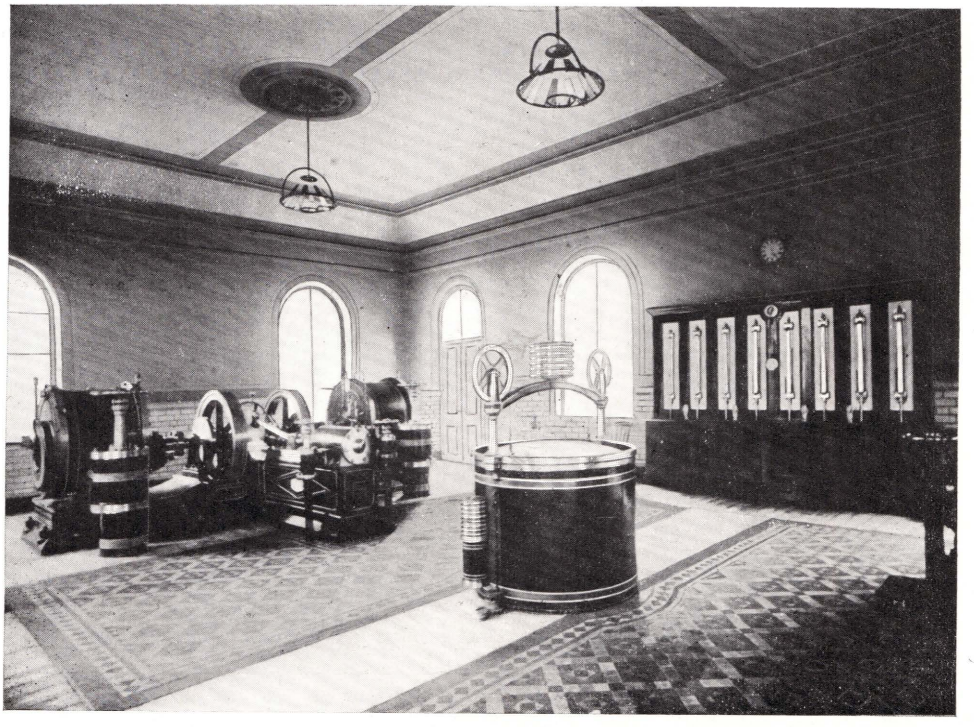
Suitable for Paper Mills, Rice Mills, Jute Mills, Oil Mills, Cotton Mills, &c.

For quotation purposes please say I.H.P. required, steam pressure revolutions, and whether for rope, belt, or gear driving.



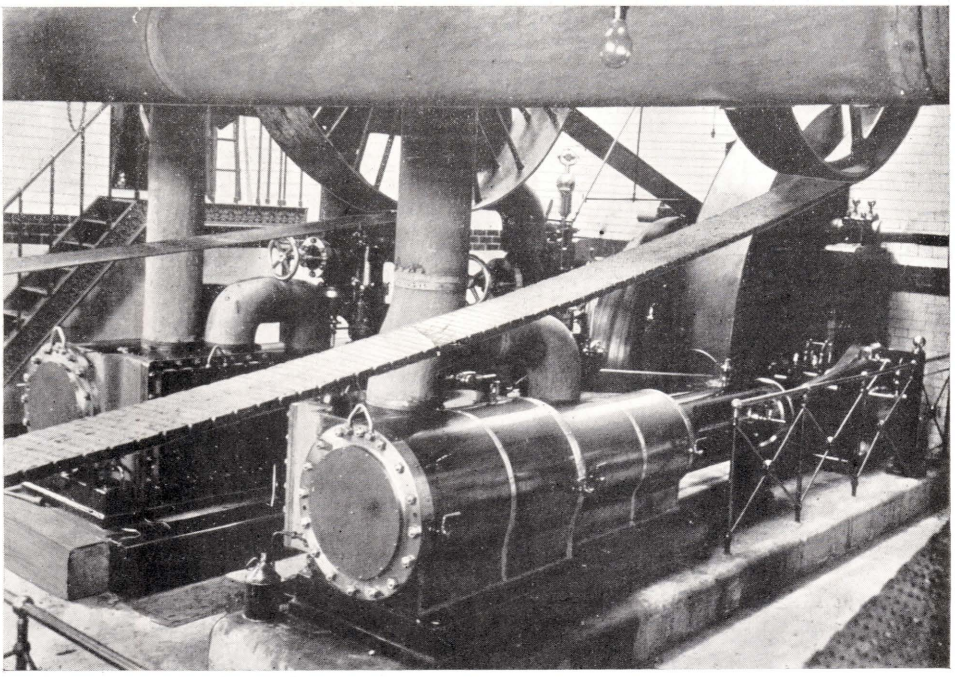
UPPER AND SECOND PLATFORMS OF VERTICAL MILL ENGINE, Showing Valve Arrangements.

The Speed Control with double-beat valve is very perfect, as there is practically no resistance to regulating gear.



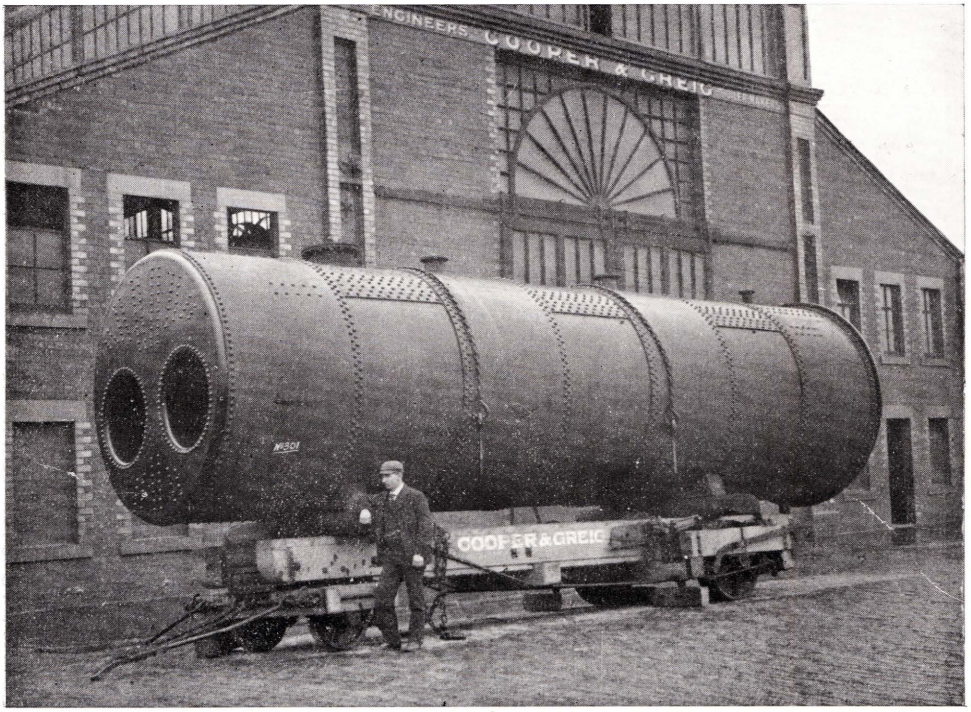
EXHAUSTERS COUPLED WITH STEAM ENGINE FOR GAS STATIONS.

Gas Exhausters and Coupled Engines for reducing pressure upon one set of mains and apparatus, while assisting with a slight pressure upon the other side to reduce load and frictional resistance.



TANDEM SIDE BY SIDE COMPOUND CONDENSING MILL ENGINES.

Tandem Compound Mill Engines can be fitted where very steady driving is required, as governor adjusts automatic cut-off valves upon both Engines at same time. These Engines have a gear drive to shaft in front for mill shaft, and also a heavy belt drive backward for driving electric generators.



HIGH-PRESSURE LANCASHIRE BOILER.

The Lancashire Boiler still retains the position of a good and economical steam producer, and has special advantages in being readily got into for cleaning should feed water contain an objectionable amount of sediment or oil. If sediment or oil is allowed into Boilers overheating may damage furnaces, and more coal is used to evaporate water. These Boilers are made with flanged furnaces and flues, also flanged back end, all flues being welded in short lengths and flanged by special machinery. Rivet holes drilled by machinery, and all riveting done by hydraulic power where practicable. Plate edges planed, and caulking done by pneumatic tools. These Boilers can be made in any size or pressure up to 200 lb.

Suitable for Paper Mills, Rice Mills, Jute Mills, Oil Mills, Cotton Mills, &c.

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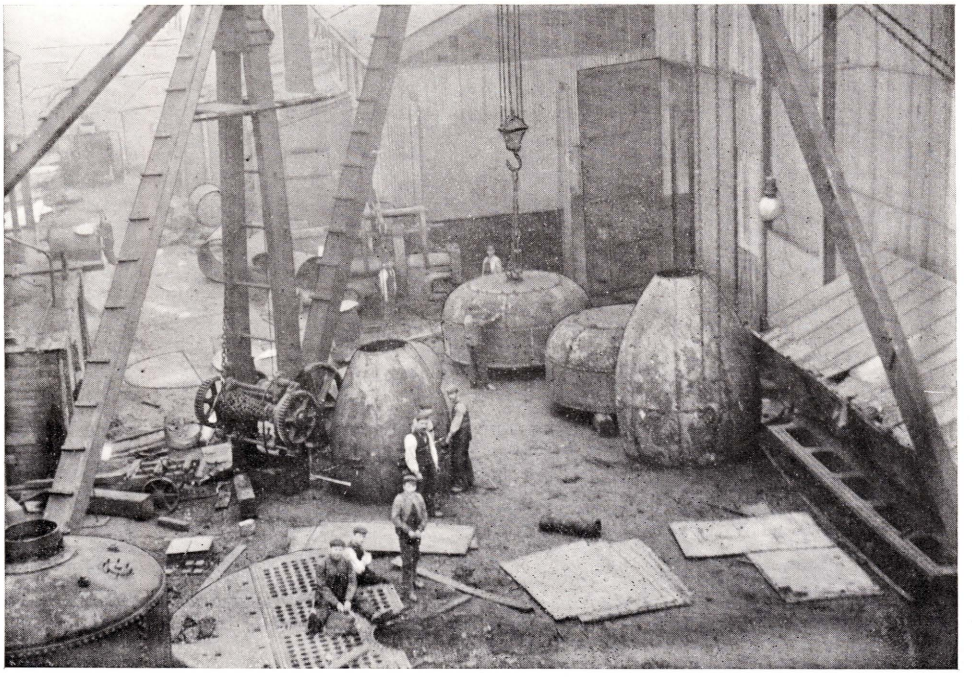
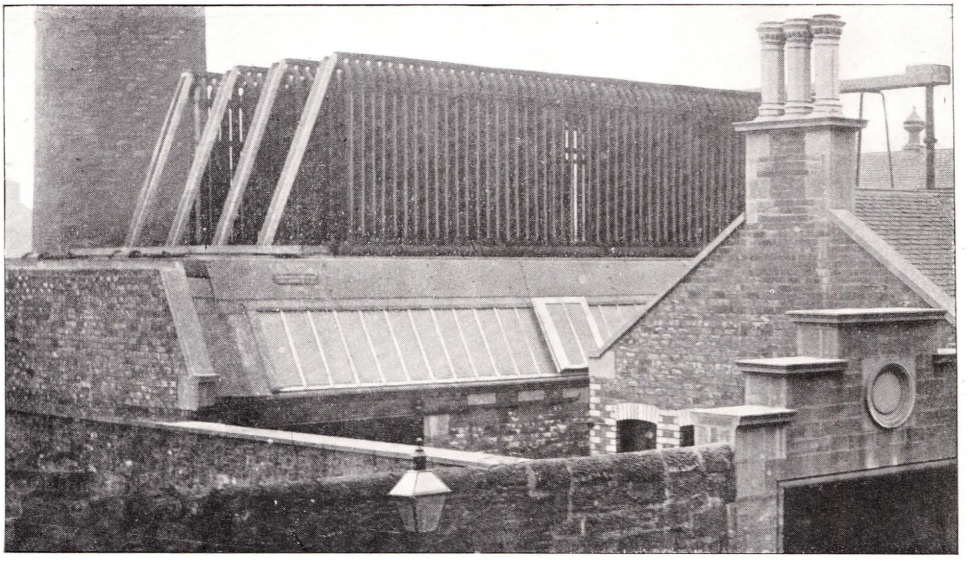


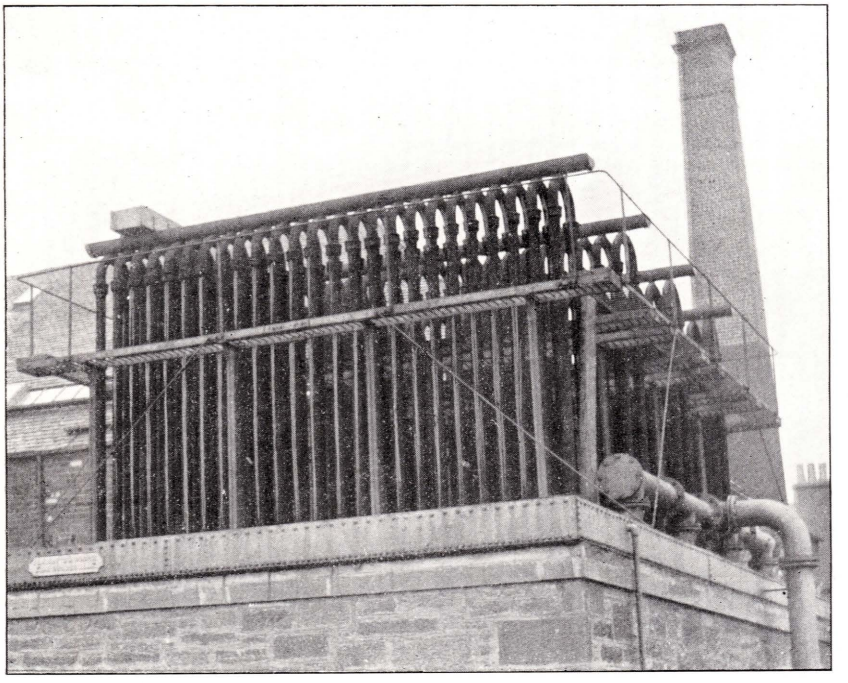
BUOYS FOR RIVER SERVICE—LIGHTING, ELECTRICAL CABLES, &c.

Floating Buoys for lighting rivers, or service in laying down Electric Cables, &c., are made in steel of any shape or size to suit requirements, and fitted with the latest automatic lighting apparatus. For quotation purposes please send outline sketch showing shape and dimensions, &c., as there are so many different sizes and particulars for different situations.



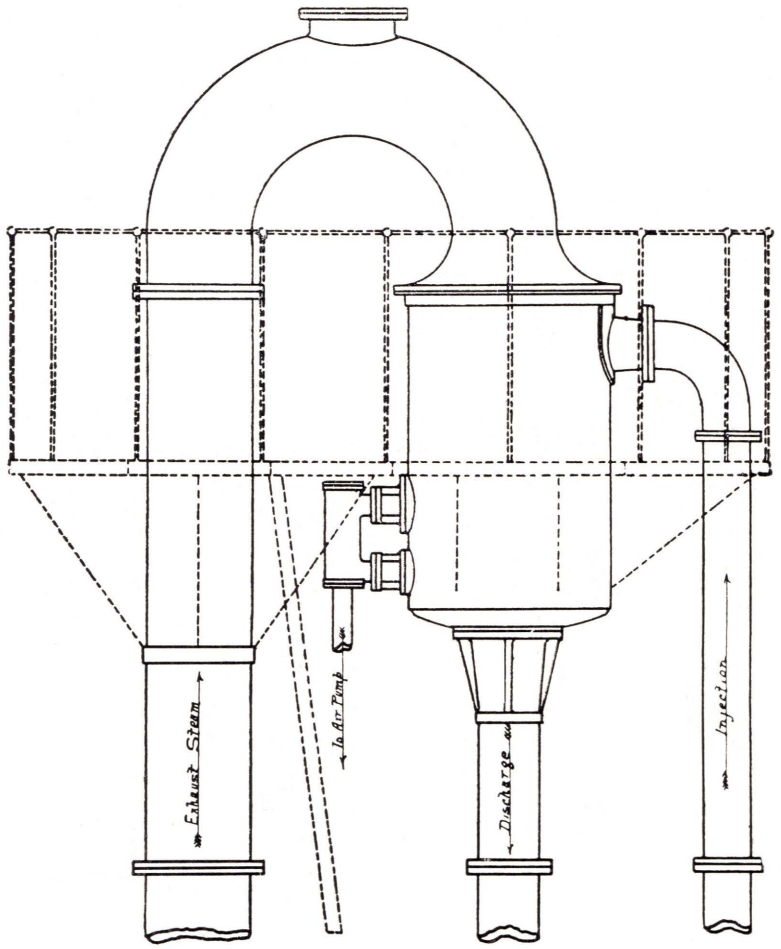
STANDARD TYPE OF EVAPORATIVE CONDENSER
in Separate Narrow Tanks.

For Electric Lighting Stations, Mills, and Coal Pit work, the separate tanks allow for expansion when Condensers cover a large roof area, each tank being bridged over between top edges by reverse curved plates or frames with roof-lights, so that the engine-room or workshop underneath may have light and ventilation as required. The tanks are made with curved under edges four to five feet in breadth, forming a very neat and strong roof, especially where roof-lights are placed between each section. The advantage of an Evaporative Condenser is not fully recognised by power users. The water required for operation has not to be cooled after use, condensation being effected by evaporation of water directly from outside of tubes, not as with ordinary jet or surface Condensers, the cooling of water being a separate process which must be completed before water can be used again. By using our Evaporative Condenser where a non-condensing engine has been in use the saving in coal and water alone repays the cost of installation within a very short time. Where cooling ponds take up valuable space, we have fitted those Condensers, as shown in plates, upon roof of buildings. A vacuum of 25-27 inches being obtained with reasonable sizes, a 28 inch vacuum requires larger sizes. We have had Condensers in use for over twenty years, and having broken pipes for examination have found them as good as when originally supplied. These Condensers cost practically nothing for upkeep, year in and year out.



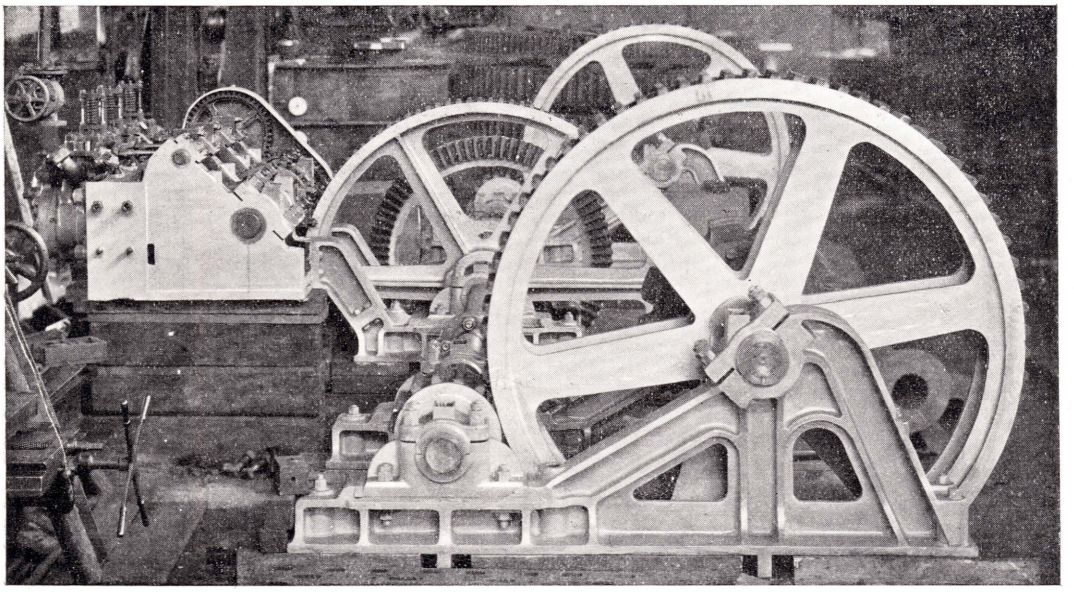
EVAPORATIVE CONDENSER in a Large Single Tank, forming Complete Roof to Engine Room.

These Evaporative Condensers we have constructed for many years. They require no particular attention other than to keep the troughing along top of bends free of any articles which might be deposited by the wind. The water evaporating from outside of Condenser amounts to about three-fourths the weight of feed water condensed from steam, so that where Engines are being used non-condensing, an immediate and great economy may be obtained by fitting in position an Evaporative Condenser and Air Pump. With any other form of Jet or Surface Condenser the water after being once used must be cooled before further use, but with the Evaporative Condenser no re-cooling is required. The actual work of condensation is completed by the evaporation of water from outside of pipe surface while the condensation of steam goes on inside, the latent heat being carried off to the atmosphere without further manipulation. Where space is cramped we supply Evaporative Condenser with Fan Draught. This of course adds to the working costs in power spent in driving fans, although the saving in capital costs and fuel would in many cases discount the cost of power required.



BAROMETRIC CONDENSER HEAD WITH CONTRA OR PARALLEL FLOW CONDENSING CURRENTS.

This form of Condenser dispenses with Air Pump for ordinary use, and only requires a Circulating Pump or supply of condensing water to reach the water inlet with sufficient pressure to enter and meet discharge of exhaust steam. After the Condenser is at work the power required to lift water for condensing purposes is diminished in respect of vacuum being obtained in Condenser Head. Where injection water is heavily charged with air, or where a specially near approach to the limit of barometric pressure is required, a dry air pump connection should be used along with the discharging action of discharge water into sump tank. With Barometric Condenser in use there is no danger from water of condensation reversing and getting back into Turbine or Reciprocating Engine, as has happened with ordinary forms of Jet Condensers. With Evaporative Condenser, ordinary Surface Condenser, or Barometric Condenser, the returning of water to engines becomes practically impossible, as the water must go out at the free open end, either at sump tank or through air pump. We also supply Jet Spray Open Coolers for Cooling Tanks, or Framed Coolers, Open Stacks, or Towers, where space has to be considered.



TRIPLE HYDRAULIC ENGINE AND GEARING.

One of Several Sets made for H.M.S. Dockyards for Pontoon Dock Gates.

Hydraulic Gearing as a means of rotary or direct lift is most useful where occasional power is required. The Triple Hydraulic Engines for Dock Gearing works with a water pressure from 600 lb. to 1000 lb. per square inch. Valves and casing are of gun metal, valves being balanced so that no friction strain comes upon faces. The reversing valves are also balanced, so that operator has full control and automatic stopping gear has no friction load to overcome. The pitch link chains are machine divided for this gearing, and tested with a working load of 36 tons each. We also make Hydraulic and Electric Power Lifts both for passengers and goods, Electric Hauling Gear, and Steam Hauling Gear for rope gear overhead, &c.

COOPER & GREIG · Ltd
Engineers & Boilermakers
· DUNDEE ·

Superheaters

(COOPER & GREIG'S PATENT).

THE Tubes are of solid drawn steel and are fitted in pairs into heavy steel crossheads, into which the tubes are expanded. Tubes project above level of crosshead, and are fitted with copper ring asbestos joints pulled up by heavy bolts, such joints being quite solid and proof against leakage or pressure. The Cross Main is also in steel with vertical divisions, so that steam from boiler passes through the whole set of tubes from one side to the other. We have fitted these Superheaters for many years, and experience has proved that the tubes keep perfectly clear, the scour of gas preventing any coating forming upon them. In this way the snperheat remains constant from 550F to 600F depending upon breadth of flue or position of Superheater. Where required we fit Superheaters into separate downtakes with adjustable dampers. The Superheaters may be fitted for independent firing, or may be fitted to suit Water Tube Boilers as desired. The economy we have obtained by introducing the Superheater where engines and boilers have been burdened has been over 20 per cent. in coal. Any pair of tubes may be removed and replaced through top door within a few minutes if required without disturbing any other pair.

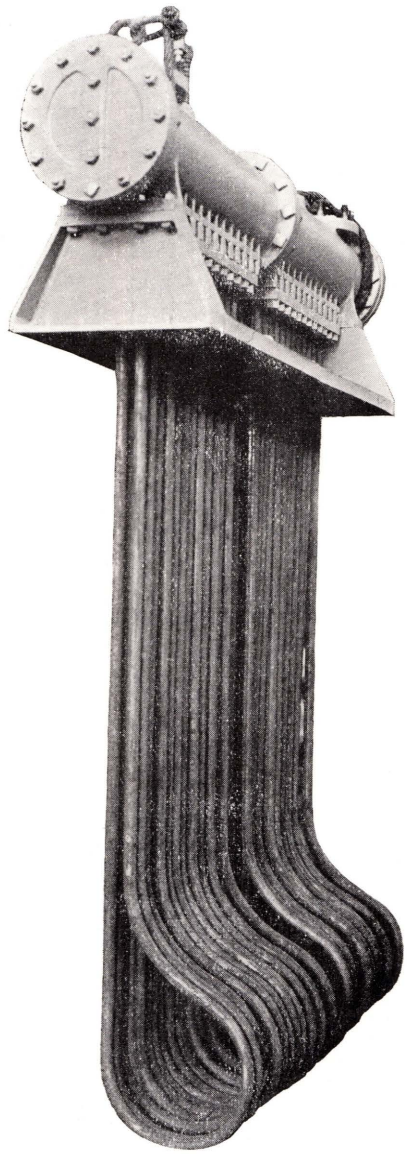
The Tubes of Superheater are shown straight on photo, but we re-set them for double flow of hot gas to suit any downtake. Angle doors are fitted upon bevel sides of carrying brackets.

Supplied to many Textile Mills and General Factories.

References on Application.

Approved by Boiler Insurance Companies.

Suitable for Water Tube Boilers.



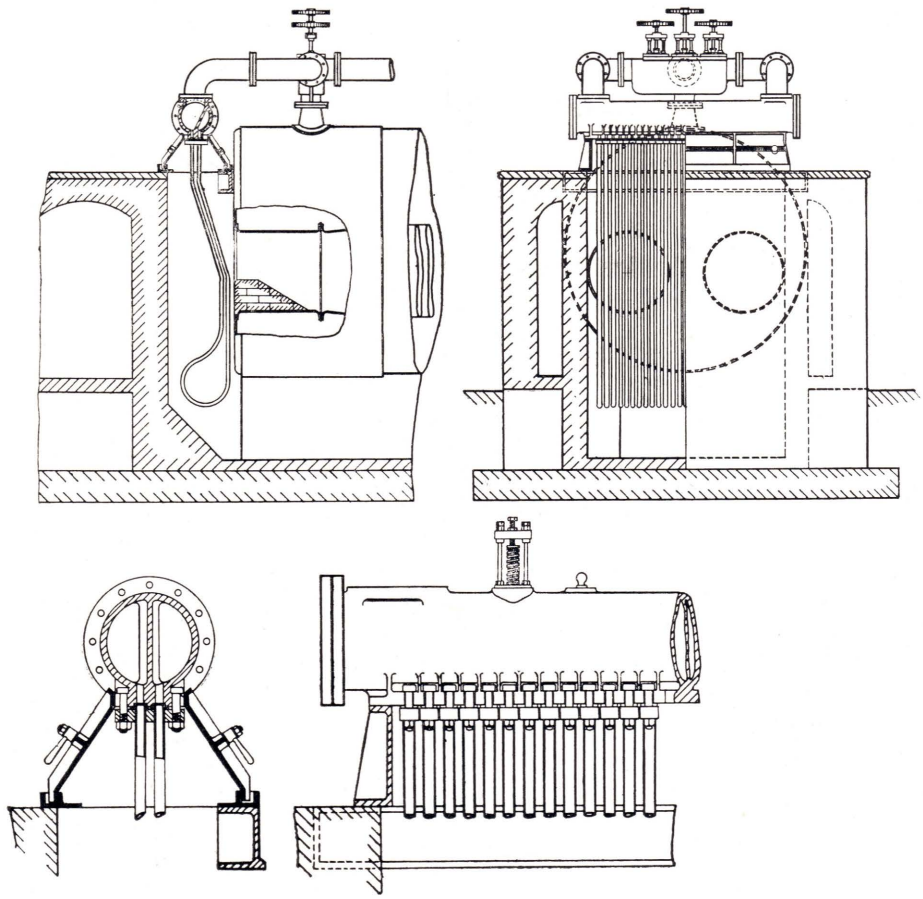
SPECIAL FEATURES.

All Tubes can be removed and replaced within a few hours.

No large flat joints; all ring joints in copper and asbestos.

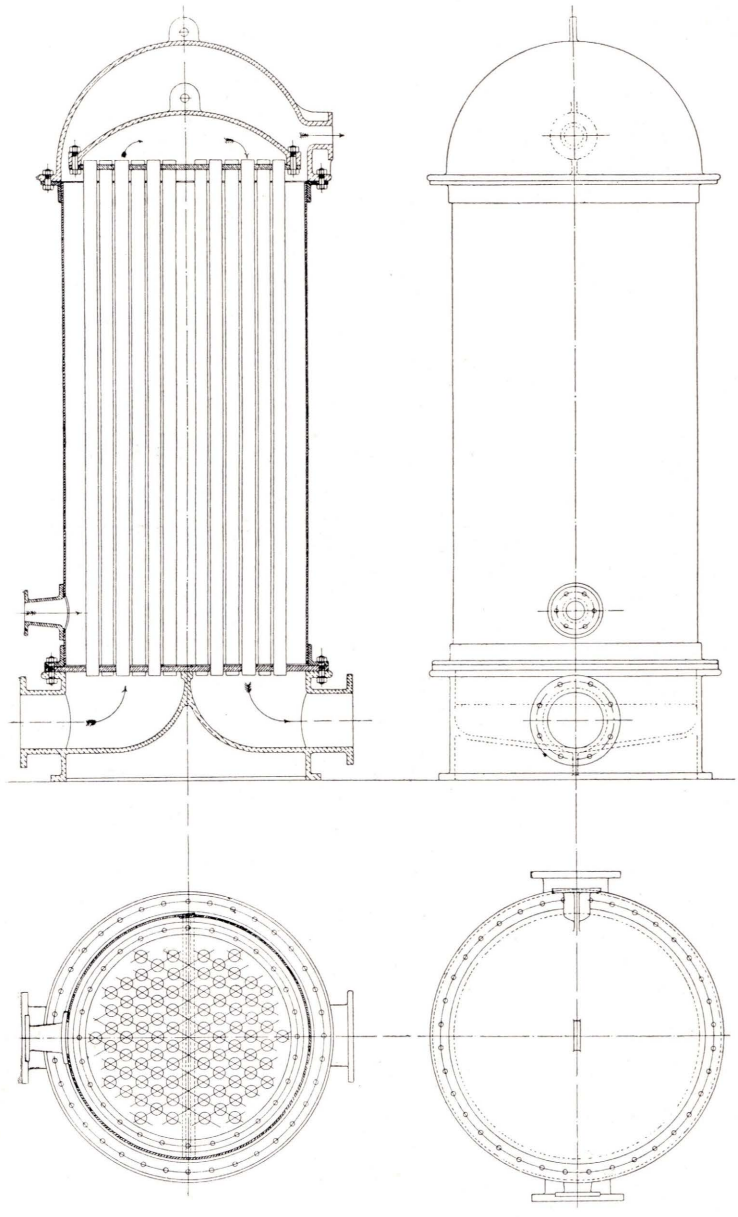
No joints buried in brick work.

All Coils accessible and easily withdrawn for examination without risk of damage.

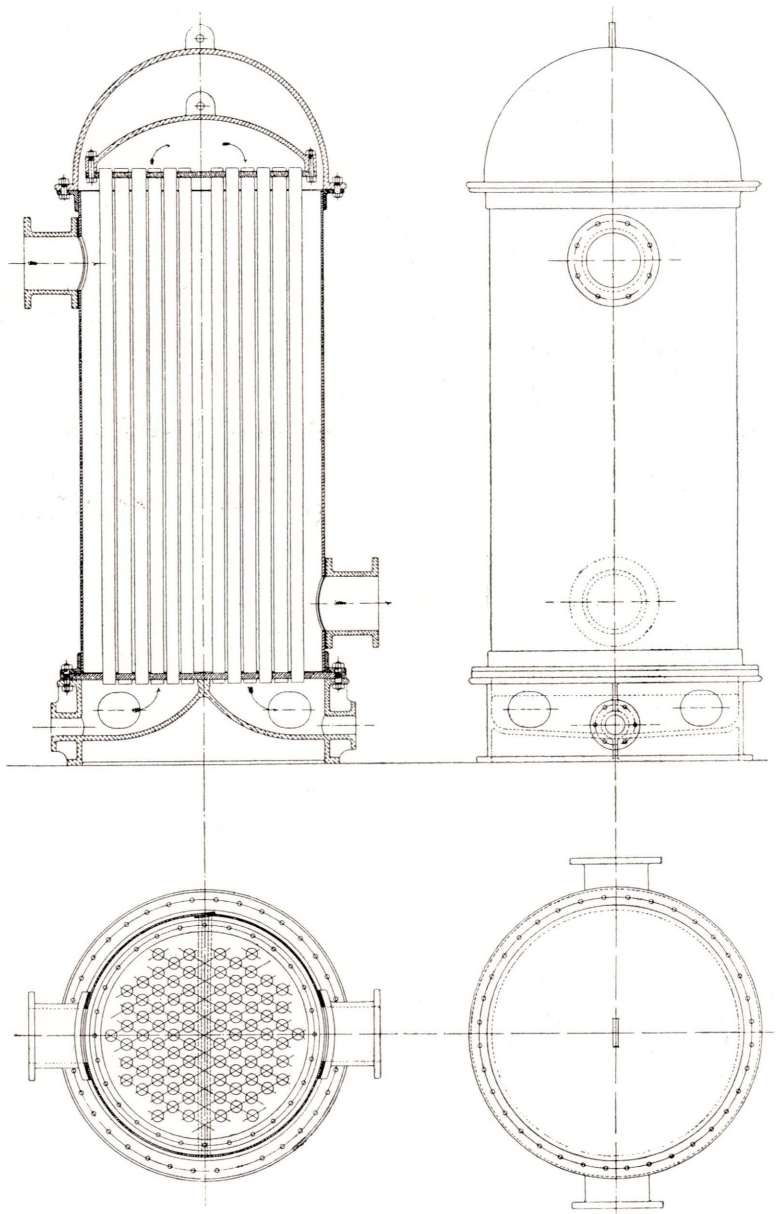


STEAM SUPERHEATER for ORDINARY LANCASHIRE BOILER.

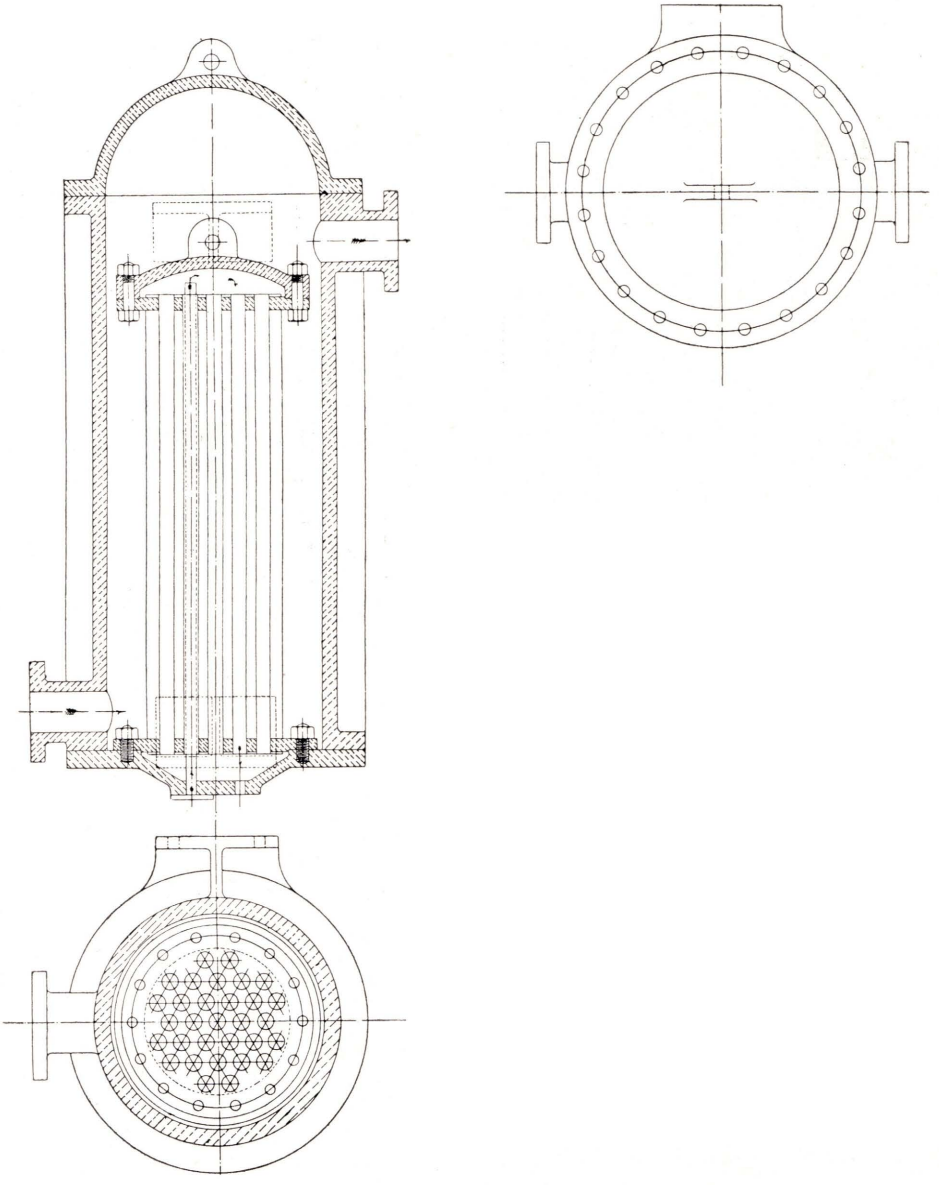
The tubes are of solid drawn steel and are fitted in pairs into heavy steel crossheads, into which the tubes are expanded. Tubes project above level of crosshead, and are fitted with copper ring asbestos joints pulled up by heavy bolts, such joints being quite solid and proof against leakage or pressure. The Cross Main is also in steel with vertical divisions, so that steam from boiler passes through the whole set of tubes from one side to the other. We have fitted these Superheaters for many years, and experience has proved that the tubes keep perfectly clear, the scour of gas preventing any coating forming upon them. In this way the superheat remains constant from 550F to 600F, depending upon breadth of flue or position of Superheater. Where required we fit Superheaters into separate downtakes with adjustable dampers. The Superheaters may be fitted for independent firing, or may be fitted to suit Water Tube Boilers as desired. The economy we have obtained by introducing the Superheater where engines and boilers have been burdened has been over 20 per cent. in coal, also enabling engine to carry away the full load from the start without any slowing down. Any pair of tubes may be removed and replaced through top door within a few minutes if required without disturbing any other pair.



EXHAUST STEAM FEED WATER HEATER, with Feed Water inlet at bottom and outlet at top. Suitable for Condensing or Non-Condensing Engines. The exhaust steam passing through Heater will raise temperature of water from 50° and 60° up to 140° and 200° F., according to size and whether Condensing or Non-Condensing Engine is coupled.

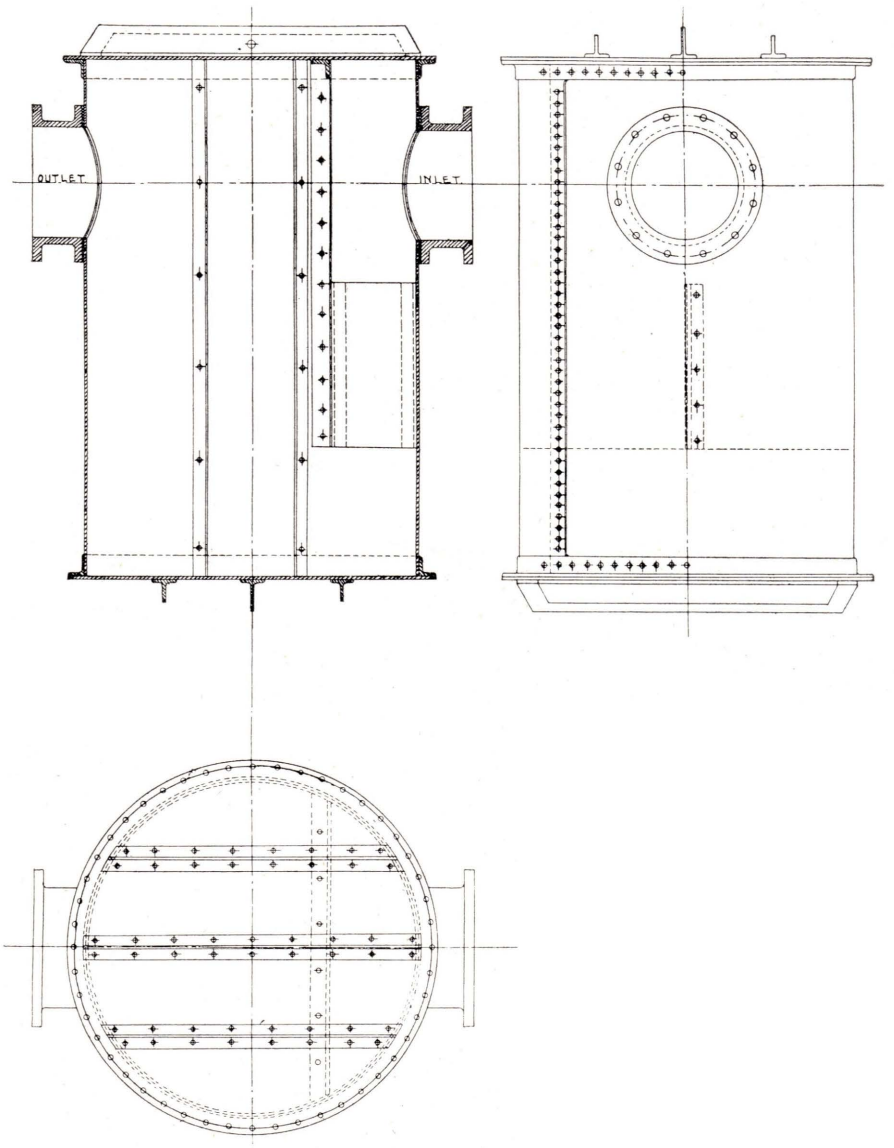


EXHAUST STEAM WATER HEATER, with Exhaust Steam inlet at top and outlet at bottom.



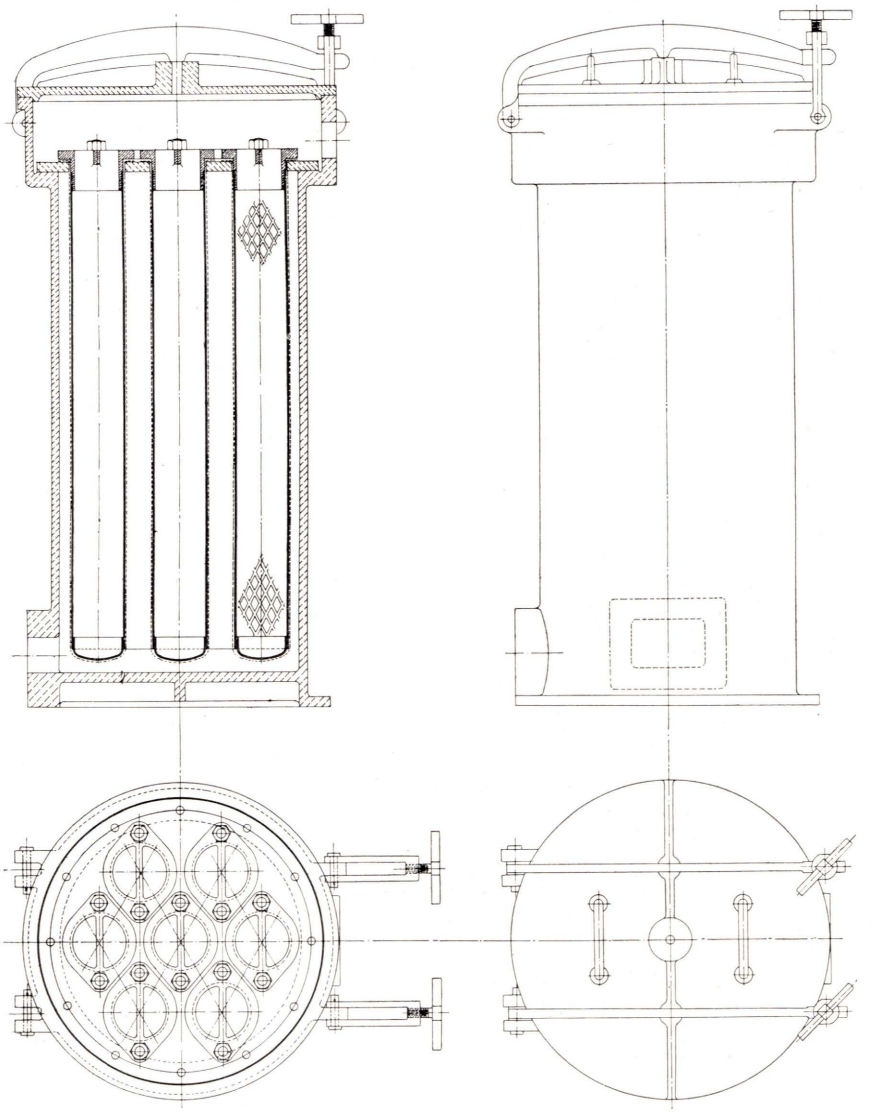
LIVE STEAM FEED WATER HEATER for High Pressure and Temperature.

The Live Steam Heater is made of any size and capacity, either in cast iron or steel plates. Tubes are in brass, tube plates in steel or brass. Saves damage against cold feed water and raises efficiency of boilers. For quotations please say quantity of feed water and pressure of steam.



OIL SEPARATOR.

With Separators complete that gather oil and water from the steam passing through without obstructing, Water Gauges, Drain Valve, and Water and Oil Traps supplied either for service over atmospheric pressure or working at low vacuum, when a Separating Pump is supplied instead of usual automatic trap.



FILTER.

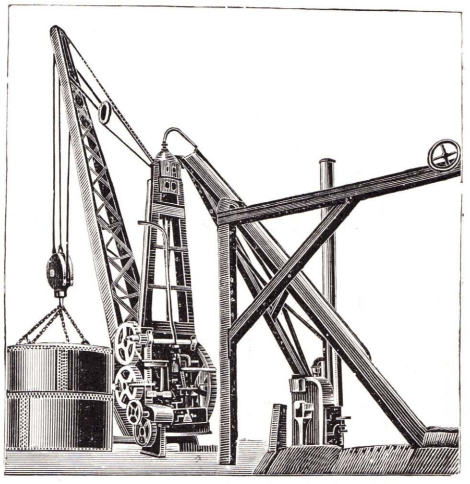
With lifting-out Cases and Hinged Cover; convenient for examination and cleaning. Water enters by bottom connection and leaves from top after passing through filtering medium. We make these Filters for suction or pressure service, and also with flat screens where such type suits the better convenience of machinery arrangements.

For quotation purposes please say quantity of water handled per hour and probable quantity of oil used for engines per hour.

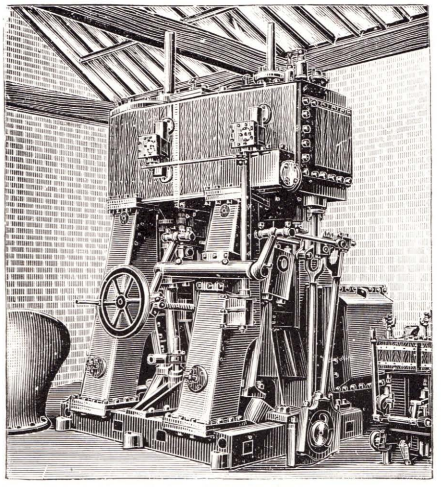
When complete separation of the emulsified oil is required, the Chemical Filter is available. We will also be glad to quote for these; but for ordinary purposes, where boilers are regularly examined and cleaned, the Mechanical Filter answers perfectly.

ONE SET OF SEVERAL BRIDGES MADE FOR CROSSING DOCK ENTRANCES.

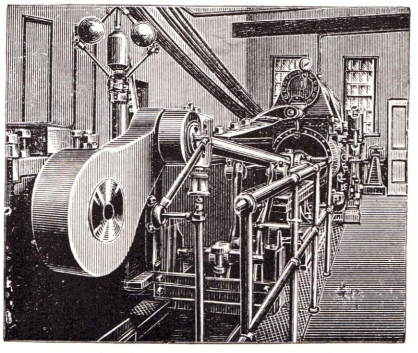
These Bridges are made in high tensile steel, and designed so that the weights are balanced upon the Cantilever principle. The Bridge being in two portions, each supported upon conned rollers moving upon a turned path of iron, which along with the centre pedestal is bolted to foundation, the centre pedestal is so formed that Bridge is held in exact position upon race, and also prevented from any vertical movement. Guide rails are placed about entrance to Bridge, so that a steady movement is obtained in opening and closing. When Bridge is brought into line for traffic two interlocking wedge blocks are fitted at junction of each half Bridge, these preventing side movement and vibration from crowding upon centre. The deck planking is in oak bolted so that renewal is readily accomplished.



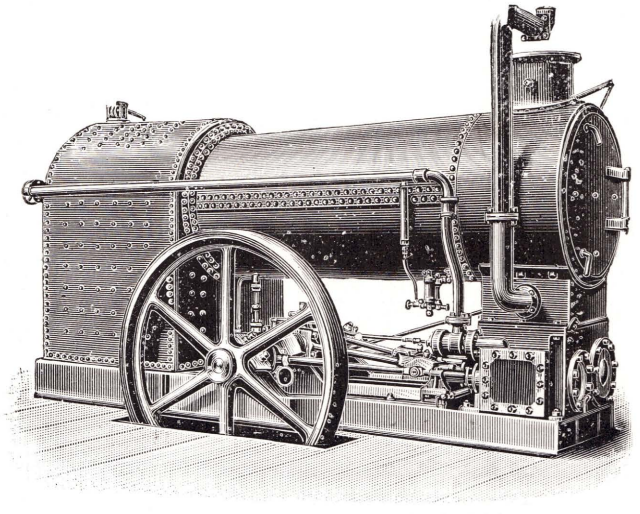
50-Ton Lift STEAM DERRICK CRANE
entirely in Steel.



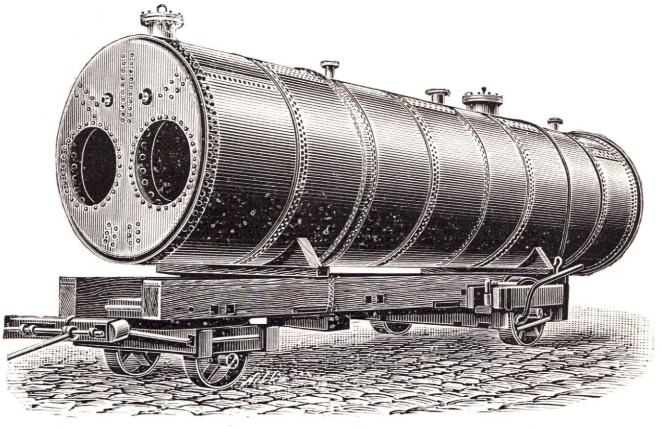
COMPOUND MARINE ENGINE
for Whaling Vessels. Extra Heavy, for breaking up ice.



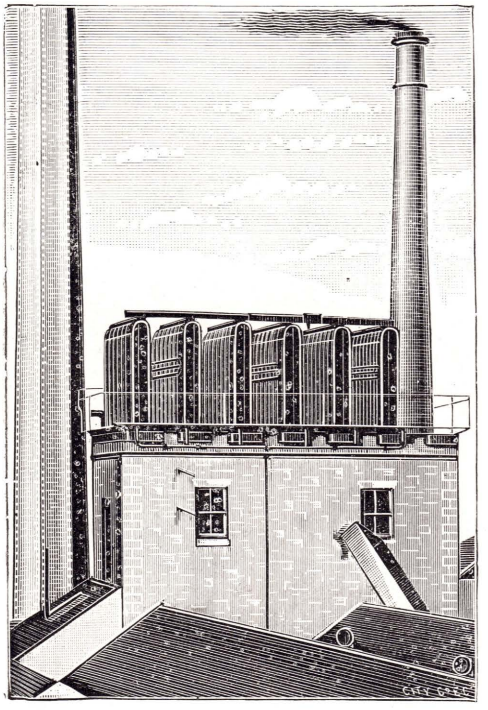
5 Feet Stroke HORIZONTAL CORLESS TANDEM COMPOUND MILL ENGINE.



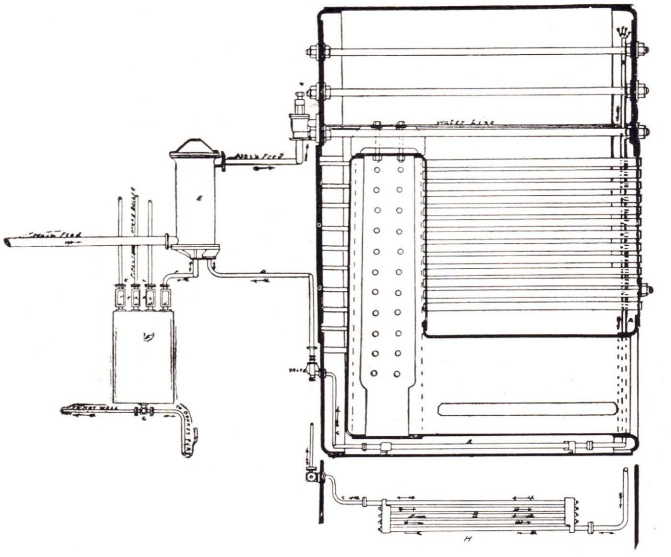
HIGH-PRESSURE COMPOUND SEMI-PORTABLE ENGINE for Saw Mills, Lighting, &c.



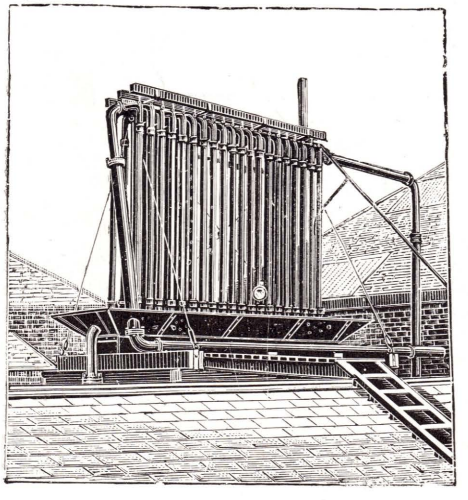
HIGH-PRESSURE LANCASHIRE BOILER
on Truck, ready for dispatch.



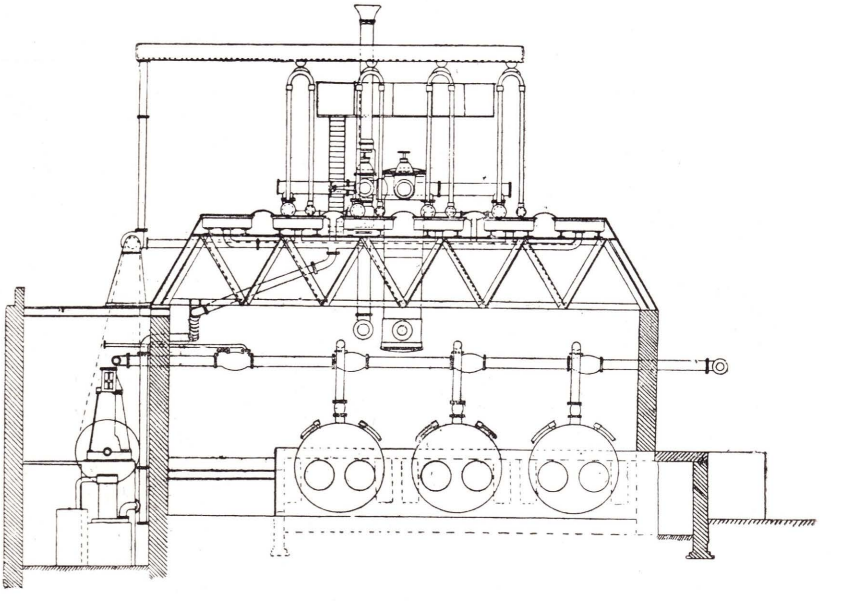
EVAPORATIVE CONDENSER
taking Steam from three sets of Mill Engines and working with one Air Pump.



THERMO CIRCULATOR, fitted to Marine or other Boiler for equalising temperature of bottom with top and preventing expansion strain.



EVAPORATIVE CONDENSER
placed on top of factory roofing without disturbing same.



Cross Section of Electric Lighting Station showing our EVAPORATIVE CONDENSER with our Boilers, Valves, independent Air Pumps and Piping.

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Section of MACHINE SHOP (looking East).

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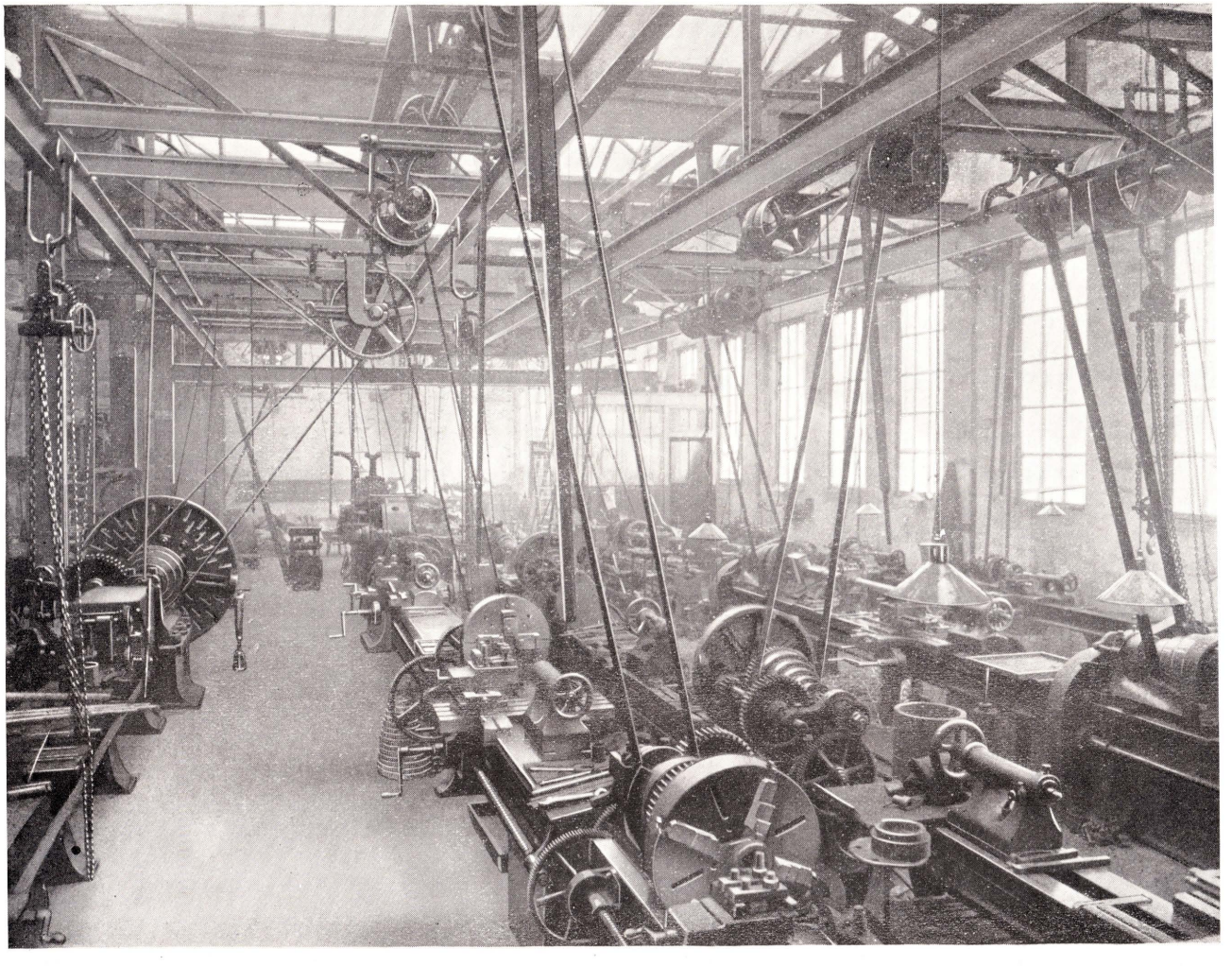

Section of LIGHT MACHINE SHOP.

COOPER & GREIG · Ltd
Engineers & Boilermakers
DUNDEE

One of Several Vessels Fitted out by us with MACHINERY.

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& Co.,
Printers
DUNDEE